

### What is a Volcano?

A volcano is an opening which occurs on the Earth's surface, where molten (liquid) rock is spewed out from under the ground. They can appear as cone-shaped mountains or as wide sloping hills, some even occur under the sea. Volcanoes have helped to shape much of the Earth's surface.

### Why do they happen?

Is the ground beneath your feet solid? You would think so wouldn't you! However, the surface of the Earth is like a giant 3D jigsaw puzzle. These enormous puzzle pieces, called tectonic plates, fit together tightly. The magma, which forms under this layer, or crust, is under so much pressure it is almost solid. As the plates move, the pressure is released, allowing the magma to melt and bubble up through the gap, as a volcano.

### Why do volcanoes erupt?

There are 500 active volcanoes around the world and approximately 60 of these will erupt each year. Even as you read this, there could be at least 10 volcanoes blowing their top! An eruption happens when magma collects inside the magma chamber, deep below the volcano. Magma is lighter than the surrounding rock, so it begins to rise to the surface. Whilst rising through the crater pipe and vents, bubbles begin to form. Slowly, the pressure builds up and the magma and gas (dissolved in the magma) gush upwards, forcing its way out. When the magma hits the surface, it becomes known as lava.

### Did you know that not all volcanoes are the same?

What kind they are, depends on how they erupt! Shield volcanoes produce a hot, runny lava, which flows from the volcano's vents. The lava spreads over a wide area, helping to create a gently sloping volcano. Their eruptions are known as *Hawaiian eruptions*. When a cinder cone volcano erupts, hot ash, lava and rocks shoot high into the air, creating tall, steep slopes with a crater on the top. These eruptions are called *Strombolian eruptions*. A stratovolcano is made by big, blasting explosions. First, lava shoots out and coats the mountain. Next comes the rock and ash, followed by more lava. This pattern continues, helping to build up the layers of lava, rock and ash. This destructive eruption is known as a *Plinian eruption* (named after Pliny the Elder, who died helping people escape the eruption of Mount Vesuvius in AD 79).

### So what makes a volcano so deadly?

**Lava flows** – These are extremely dangerous. They can knock down buildings, bury objects and set light to flammable materials. However, most lava flows travel slower than walking pace, so people and animals have a good chance of escaping.

**Ash** – This can be deadly. It feels like finely crushed glass, and is often scorching hot. This settles over huge areas, suffocating people and animals.

**Gas** – Carbon dioxide and sulphur dioxide are examples of gases which can be blasted out of an erupting volcano. As carbon dioxide is heavier than air, it can settle in low-lying areas, creating a poisonous environment. Sulphur dioxide causes acid rain and air pollution.

**Lahars** – These devastating mudflows are caused by hot volcanic materials combining with water, snow or ice on volcanic slopes. These unstoppable mudflows slide down the slopes, ripping houses and trees from the ground.

**Pyroclastic flow** – When large amounts of ash and gas explode out of the volcano, deadly pyroclastic flows can occur. Amazingly, temperatures inside the flow can reach hundreds of degrees Celsius. These destructive flows of boiling gas and ash, travel at terrifying speeds, destroying everything in their path. The pyroclastic flow from Mount Pelée in 1902, completely destroyed the town of Saint-Pierre, in Martinique. Almost every person in the town perished.

### Active, dormant or extinct?

For a volcano to be classed as active, it is either erupting now, or is likely to erupt soon. According to scientists, an active volcano must have erupted during the last 10,000 years. A dormant volcano on the other hand, could be described as sleeping, because it is still active, but not currently erupting. If a volcano has not erupted during the last 10,000 years, then it can be classified as an extinct volcano, however experts can't be completely sure that it will never erupt again!

### How deadly can a volcano be?

We tend to think that volcanoes only affect areas in close proximity to it, however, it is quite possible for a single volcano to have a huge impact on large sections of the Earth and its climate. This was proved to be true in April 1815, when the Indonesian volcano Tambora erupted. The ash column from Tambora reached a staggering height of 43 kilometres. Wind helped to spread the ash and gases around the world. The following year, 1816, was known as 'the year without a summer'. North America, northern Europe and China suffered frosts and snowstorms throughout the months of May and June. Crops failed and thousands of people starved, or were so weakened that they succumbed to diseases. Over 90,000 people died.

### Can the power of an eruption be measured?

The power of an eruption is measured on the VEI scale, otherwise known as the Volcanic Explosivity Index. This is based on the amount of material erupted from a volcano, and the height of the accompanying ash column. The VEI scale is composed of 8 stages in total, with stage 1 being a 'gentle' eruption and stage 8 being classed as a 'mega colossal' eruption! Tambora had a VEI of 7 (super-colossal), Mount Vesuvius had a VEI of 4, meaning 'cataclysmic'! Scientists believe that a VEI 8 eruption happens once every 100,000 years. These are called super-eruptions! The last super-eruption occurred in Indonesia, over 74,000 years ago, when Toba erupted - its effects nearly wiped out the human population. So when and where is the next super-eruption due? A prime suspect is Yellowstone National Park in the USA, which has seen three super-eruptions over the last two million years!

### Can we predict when a volcano will erupt?

Scientists, called volcanologists, monitor volcanoes in the hope of predicting future eruptions. An analysis of gases can tell them many things, for example, an increase in sulphur dioxide may indicate that fresh magma may be near the surface, meaning an eruption could be imminent. Scientists also use a seismograph to measure movements in the ground, which occur before an eruption. This technology helped predict eruptions at Mount Redoubt, Alaska, in 1989 and at Popocatepeti near Mexico City in 2000. It is also important to study old lava flows, as they can provide evidence of the frequency and size of past eruptions. Scientists cannot prevent volcanoes from happening, but they can predict when a volcano might erupt and with what force, helping people to escape in time!

## Can volcanoes help us?

Millions of people live near active volcanoes, meaning that one in ten people living in the world today are at risk of dying, or being injured if an eruption were to occur. However, there are many benefits to living within proximity of a volcano. Volcanic soil is very fertile, making it ideal for growing crops. In addition to this, heat energy from the Earth (geothermal energy) can also be harnessed to power villages and towns. Power stations pump water into the ground, where it becomes heated by the extremely hot rocks. The resulting hot water is used to heat homes, whilst the steam is used to drive turbines and generators in order to create electricity. Geothermal energy is the second largest source of energy in Iceland. The Roman city of Pompeii, buried after the eruption of Mount Vesuvius, attracts 2.5 million tourists a year, which helps boost the local economy.

## Did you know?

Lava erupts at temperatures of up to 1200°C.

About 60 million years ago, an underwater volcano poured out so much lava it made new land - we know this land as Iceland!

Volcanoes can even be found in space! Astronomers have discovered volcanoes on Venus and Mars.

Mount Etna in Italy is Europe's highest active volcano.

## Glossary

acid rain	rain made acidic by the mixing of sulphur in the air
carbon dioxide	a gas which is absorbed by plants but dangerous in large amounts
crater pipe	a tube connecting a magma chamber to the surface
crust	the outermost solid layer of the Earth, between 5 and 50 kilometres thick
generator	a machine that converts one form of energy into another
economy	the system of how money is made and used within a particular country or region
magma	melted rock beneath the Earth's surface that becomes lava when it flows out of a volcano
magma chamber	hollow space underground where magma collects
seismograph	an instrument that measures vibrations within the Earth's surface
sulphur dioxide	a gas which smells of rotten eggs, it causes acid rain and can make it difficult to breathe
turbine	a machine for producing power in which a rotor fitted with blades is made to revolve
vent	openings in the Earth's surface that allows molten rock and gases to escape

## Volcanoes

What is the surface of the Earth like? (AF2)

How many active volcanoes are there around the world? (AF2)

What is magma? (AF2)

Where is the magma chamber found? (AF2)

Are all volcanoes the same? (AF3)

Which volcanoes have Strombolian eruptions? (AF2)

Why are lava flows dangerous? (AF2)

- A. They make the air poisonous.
- B. They make it hard to hard to breathe.
- C. They knock down buildings and set fire to things.
- D. They move at terrifying speeds.

Why is 'blasted' a good word to describe how gases can be erupted out of a volcano? (AF5)

How did the eruption of Tambora in 1815, manage to affect so much of the Earth? (AF3)

Why do you think so many people died after Tambora erupted? (AF3)

Write down two other words which mean the same as 'succumbed'. (AF5)

What is a VEI 8 eruption classed as? (AF2)

When is the next super-eruption due? (AF3)

What is the purpose of a subheading? (AF4)

Why is the work of a volcanologist so important? (AF3)

Identify three ways a volcano can help the people who live by them. (AF2)

In what way does tourism boost the economy in Pompeii? (AF7)

Would you like to live by a volcano? Explain your answer. (AF6)

What is the purpose of a glossary? (AF4)

## Volcanoes

What is the surface of the Earth like? (AF2) **The surface of the Earth is like a giant 3D Jigsaw puzzle.**

How many active volcanoes are there around the world? (AF2) **There are 500 active volcanoes around the world.**

What is magma? (AF2) **Magma is melted rock.**

Where is the magma chamber found? (AF2) **Deep below the volcano.**

Are all volcanoes the same? (AF3) **No, because they erupt in different ways and this tells us what type they are.**

Which volcanoes have Strombolian eruptions? (AF2) **A cinder cone volcano.**

Why are lava flows dangerous? (AF2)

- A. They make the air poisonous.
- B. They make it hard to hard to breathe.
- C. **They knock down buildings and set fire to things.**
- D. They move at terrifying speeds.

Why is 'blasted' a good word to describe how gases can be erupted out of a volcano? (AF5) **The word blasted makes you think of sudden, loud and noisy explosions, which helps the reader understand how gas is erupted.**

How did the eruption of Tambora in 1815, manage to affect so much of the Earth? (AF3) **Due to a combination of the height of the eruption (43km) and the winds helping to spread the ash and gas around the world.**

Why do you think so many people died after Tambora erupted? (AF3) **Due to the sun being blocked out for a long period of time, and the unusually cold temperatures, crops failed so there was no food for people to eat. Many died from lack of food, or became very weak, meaning they were more likely to catch illnesses and die.**

Write down two other words which mean the same as 'succumbed'. (AF5) **Various answers e.g. yielded, gave way, surrendered.**

What is a VEI 8 eruption classed as? (AF2) **Mega colossal.**

When is the next super-eruption due? (AF3) **In the next 26,000 years.**

What is the purpose of a subheading? (AF4) **A subheading tells you what the information below it is all about. They also help you to find the information you need quickly.**

Why is the work of a volcanologist so important? (AF3) **Their findings help them predict when a volcano might be about to erupt. This gives people more time to escape, meaning more lives could be saved.**

Identify three ways a volcano can help the people who live by them. (AF2) **The soil is good for growing crops. The hot ground can heat and power homes. Tourists bring money to the area.**

Would you like to live by a volcano? Explain your answer. (AF6) **Various answers. Encourage children to link answers to information they have read in the text.**

In what way does tourism boost the economy in Pompeii? (AF7) **Various answers e.g. Tourists pay to stay in hotels and eat in cafes, they buy souvenirs etc.**

What is the purpose of a glossary? (AF4) **A glossary explains the meaning of tricky words.**