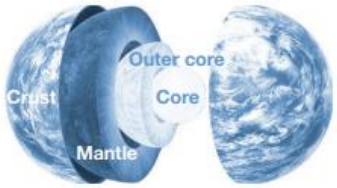
Earthquakes and volcanoes: plate tectonics

Quick summary

The Earth has an inner and outer core, a mantle and a crust. The crust is the rocky surface that makes up the surface of the Earth and floats on top of the mantle. The crust has 'cracks' in it and so it is actually in pieces. These pieces are called plates. The plates move very slightly – by no more than a few centimetres a year – and when they do, earthquakes occur and volcanoes form or erupt. **Plate tectonics** provides an explanation of how earthquakes, mountains, volcanoes and oceans are formed.

Physical features

The structure of the Earth



The main plate boundaries

Physical processes

The boundaries of the plates are called **fault lines** and movement along these lines causes earthquakes and volcanoes. The plates move in three different ways:

- **away from each other,** which forms ridges
- **towards each other,** which causes earthquakes and forms volcanoes and mountains
- **side by side,** which causes earthquakes.

Vocabulary

earthquakes: shaking of the ground caused by movement of the Earth's crust

volcanoes: mountains from which lava, gas, steam and ash from inside the Earth sometimes burst

erupt: to start suddenly or violently with great force

Location | Physical features | Human features | Diversity | Physical processes | Human processes | Techniques

POP tasks: Milestone 2 – Earthquakes and volcanoes: plate tectonics

Students will increase their understanding of the concepts in this topic by exploring:

	Basic	Advancing	Deep

 **Physical features**	• **Label** and **describe** the Earth's:
	  • core
	  • outer core
	  • mantle
	  • crust.
	• **Describe** what tectonic plates are.
	• **What** are the boundaries of tectonic plates called?
	• **Locate** and **label** on a world map the main tectonic plate boundaries.
		• **Compare and contrast** the Earth's crust and mantle.
		• **Explain** the physical features of a volcano.
		• What are the **similarities and differences** in the physical features of a volcano and a mountain?
			• **Relate** your knowledge of plate tectonics to your understanding of rocks and fossils.
			• **Investigate** how the world's continents have changed in appearance since the creation of the Earth.

 **Physical processes**	• **What** does the term 'plate tectonics' mean? • **What** happens when tectonic plates move? • **Describe** the three ways in which tectonic plates move and what happens as a result.	• **Categorise** the Earth's main tectonic plates in terms of how they are moving. • **Explain** the tectonic process that would lead to an earthquake. • **Explain** the physical process that would result in a mountain range being formed.	• **Relate** your knowledge of plate tectonics to that of mountain ranges around the world. • **Make generalisations** about the relationship between physical processes and physical features.

Earthquakes and volcanoes: the Pacific Ring of Fire

Quick summary

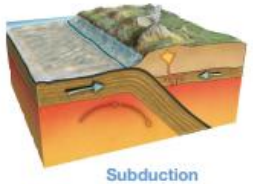
The Pacific Ring of Fire is an arc around the Pacific Ocean where most of the world's volcanoes and earthquakes are formed. About three-quarters of the world's dormant and active volcanos are here. The ring is 25,000 miles (40,230 km) long, and there are 452 volcanoes on it. About 90 per cent of the world's earthquakes, including 15 per cent of the world's largest earthquakes occur along the Ring of Fire. The Ring of Fire is a result of plate tectonics – the movement and collision of the plates that make up the Earth's crust.

Location

The Pacific Ring of Fire is an area on the boundaries of the Pacific Ocean. It follows the eastern side of Australia and Asia and the western side of North and South America.

Physical processes

The Pacific Ring of Fire is a result of plate tectonics: plates are colliding with each other which causes a process called subduction where one plate is pushed below another. The heat and the pressure forms mountains and volcanoes.



Subduction

Vocabulary

volcano: a mountain from which lava, gas, steam and ash from inside the Earth sometimes burst

earthquake: shaking of the ground caused by movement of the Earth's crust

dormant: not active, but capable of becoming active in the future

collision: when one moving object hits another

Location · Physical features · Human features · Diversity · Physical processes · Human processes · Techniques

POP tasks: Milestone 2 – Earthquakes and volcanoes: the Pacific Ring of Fire

Students will increase their understanding of the concepts in this topic by exploring:

	Basic	Advancing	Deep
 **Location**	• **Locate and label** on a map the Pacific Ring of Fire. • **Describe** the geographical location of the Pacific Ring of Fire. • **Describe** some of the features of the Pacific Ring of Fire.	• Using examples from around the world, **explain the differences** between active, dormant and extinct volcanoes. • **Explain** why about 90 per cent of the world's volcanoes happen around the Pacific Ring of Fire.	• **Investigate** the location of some of the Pacific Ring of Fire's most explosive volcanoes.
 **Physical processes**	• **Describe** how plate tectonics gives rise to the Pacific Ring of Fire. • **What** does the word 'subduction' mean?	• **Explain** the process that forms volcanoes. • **Explain** the differences between magma and lava. • What are the **similarities and differences** between the physical processes that create earthquakes and those that create volcanoes?	• **True or false?** A collision between plates is required for an earthquake to occur. • **Always, sometimes or never?** A volcano can erupt after it has been dormant for many years.

Earthquakes and volcanoes: impact

Quick summary

Earthquakes and volcanoes differ in their magnitude. Some are more violent than others. The scale for measuring the magnitude of earthquakes is called the Richter scale. Micro earthquakes measure less than 2.0 on the scale, while meteoric earthquakes measure 10 or above. Similarly, volcanoes are graded on their intensity using the Volcanic Explosivity Index (VEI). The VEI ranges from 0 (Hawaiian volcanoes are constantly erupting with low explosivity) to 8 (Ultra Plinian volcanoes erupt about every 50,000 years with extremely high explosivity). When earthquakes with high magnitude occur and volcanoes with high explosivity erupt they can cause natural disasters.

Physical processes

Examples of natural disasters caused by earthquakes and volcanoes

The 2004 Boxing Day earthquake measured 9.3 on the Richter scale. It occurred under the Indian Ocean and was caused by the movement of the Burma and India tectonic plates. It created tsunami waves 30 metres (98 ft) high and caused an estimated 228,000 deaths in countries bordering the Indian Ocean.

The 1906 San Francisco earthquake in the United States of America had a magnitude of 7.9 and caused violent shaking. Buildings collapsed and fires broke out in the city and lasted for several days. Up to 3000 people died and over 80 per cent of the city of San Francisco was destroyed.

In 79 CE, Mount Vesuvius in Italy erupted with tremendous force. It sent a deadly cloud of gas into the air and ejected ash, rocks and lava which fell on the nearby Roman towns of Pompeii and Herculaneum. Thousands of people were killed by the falling ash and rocks, and some were killed instantly as the deadly gas suffocated them.

Location

Location of the 2004 Boxing Day tsunami

Vocabulary

magnitude: the size or scale of something

meteoric: sudden and extremely strong

intensity: magnitude

tsunami: a very large wave, caused by an earthquake

Location | Physical features | Human features | Diversity | Physical processes | Human processes | Techniques

POP tasks: Milestone 2 – Earthquakes and volcanoes: impact

Students will increase their understanding of the concepts in this topic by exploring:

	Basic	Advancing	Deep

 **Location**	• **Locate** and **label** on a map areas that have examples of the lowest and highest intensity volcanoes.
	• **Locate** and **label** on a map the areas affected by the:
	  • 2004 Boxing Day tsunami
	  • 1906 San Fransisco earthquake
	  • 79 CE eruption of Vesuvius.
		• **Compare and contrast** the geographical locations of mountainous areas with extinct volcanoes and mountainous areas with active, high-intensity volcanoes.	• **Investigate** the extent of the area affected by the 2004 Boxing Day tsunami.

 **Physical processes**	• **What** does the word 'magnitude' mean when it is used to describe earthquakes and volcanoes?
	• **Describe** the scale for measuring the magnitude of earthquakes.
	• **Describe** the scale for measuring the intensity of volcanoes.
	• **What** is a tsunami?
	• **Describe** the impact of the:
	  • 2004 Boxing Day tsunami
	  • 1906 San Fransisco earthquake
	  • 79 CE eruption of Vesuvius.
		• **Compare and contrast** the impact of a volcanic eruption and an earthquake.	• **Investigate** the consequences of the eruption of Mount Vesuvius in 79 CE.