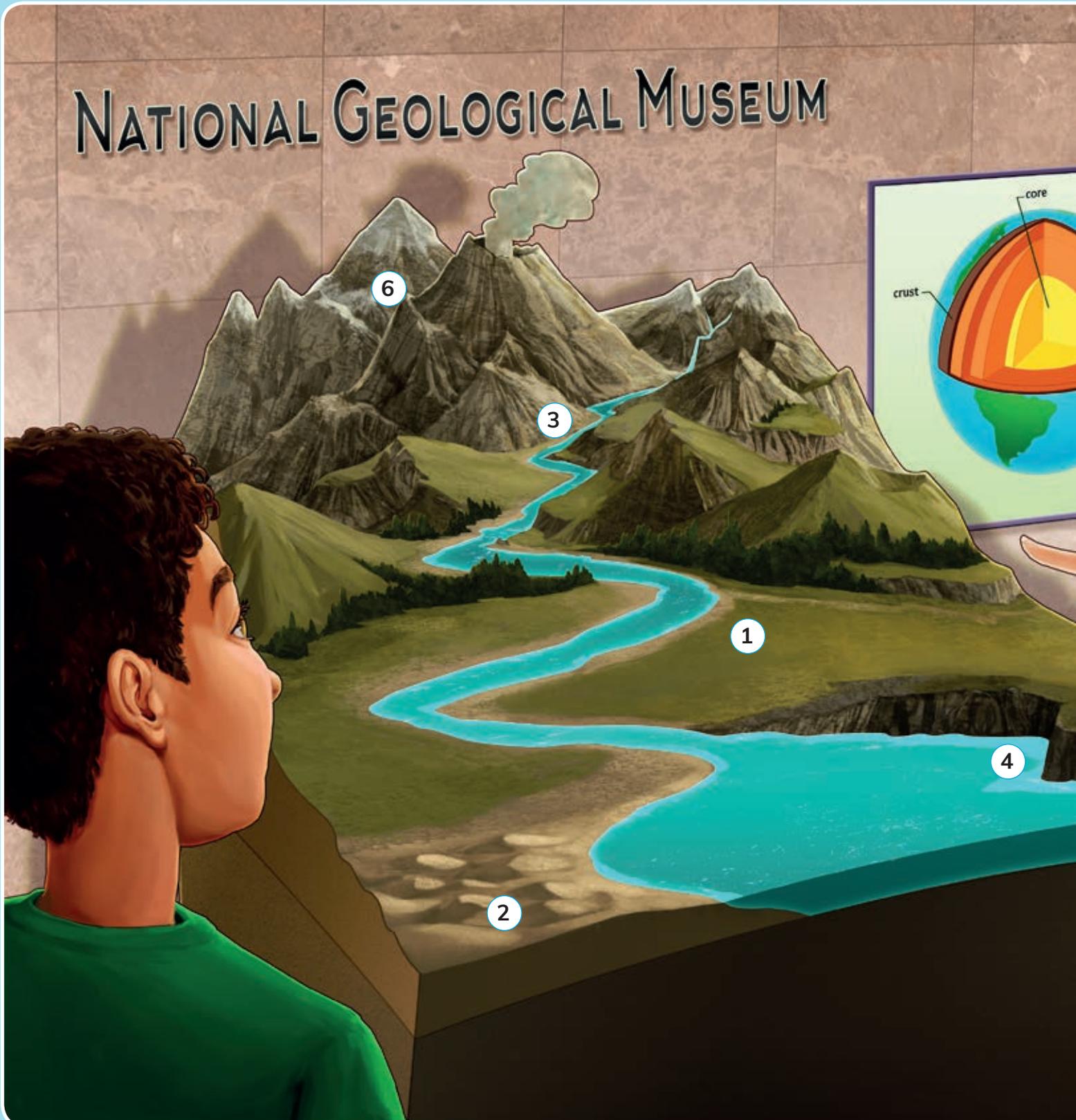
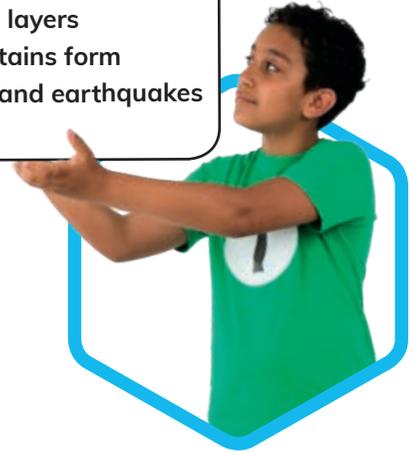


1 Watch. Name three things that geology studies.



Let's learn about ...

- the Earth's layers
- how mountains form
- volcanoes and earthquakes
- erosion



2 Look at the museum display and answer the questions.

- How many layers has the Earth got?
- What's special about the mountain in the centre of the model?
- Which tectonic plate do we live on?

3 Work with a classmate. Look at the model and match the names to the landforms.

- | | |
|-------------------|---------------|
| a. mountain range | d. cliffs |
| b. valley | e. bay |
| c. plain | f. sand dunes |

Be mindful



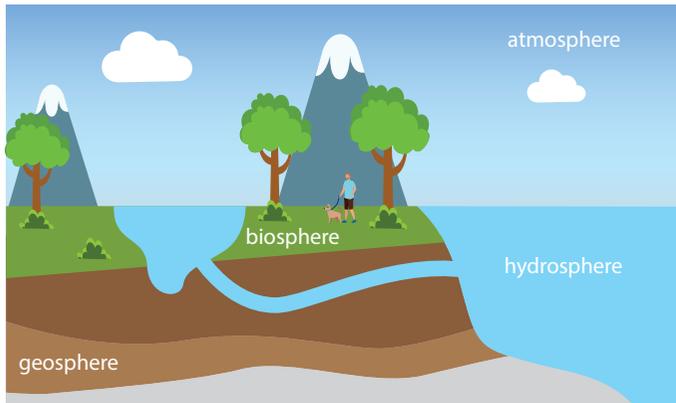
Close your eyes and listen.
What effect do you think the water has on the rock? 001

What are the Earth's spheres and layers?

The Earth has got four spheres or systems: the **atmosphere**, the **hydrosphere**, the **geosphere** and the **biosphere**. In addition, the Earth has got three internal layers: the **crust**, the **mantle** and the **core**.

1 Watch. How deep is the deepest hole that humans have made?

Scientists use four spheres to classify all the matter on Earth: the **atmosphere**, the **hydrosphere**, the **geosphere** and the **biosphere**.



The names of Earth's spheres come from these Greek words: *atmós*, *hydros*, *geos* and *bios*.

2 Look at the picture. In your notebook, match the Greek words to their meanings.

- | | |
|------------------|-----------|
| a. <i>atmós</i> | 1. ground |
| b. <i>bios</i> | 2. water |
| c. <i>geos</i> | 3. life |
| d. <i>hydros</i> | 4. air |

3 Copy and complete the sentences.

- The is the solid part of the Earth. It includes the ground that we walk on and all the layers of rock below the surface too. It contains rocks and minerals.
- All living things make up the . It includes animals, plants and microorganisms.
- The contains all the water on our planet. It includes surface water, such as oceans, seas and rivers. It also includes groundwater and ice.
- All the gases that surround the Earth make up the .

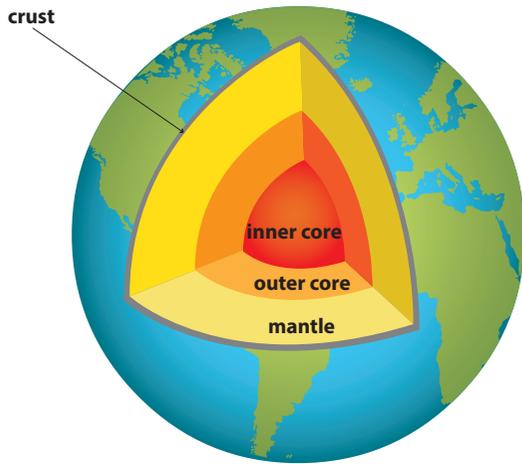
All of the Earth's spheres are interconnected: they interact with each other and work together. For example, the hydrosphere and the atmosphere interact in the water cycle. When a **volcano** erupts, it releases gases into the air. This is an example of the geosphere interacting with the atmosphere.

4 Listen and match the photos to the descriptions. 002



The atmosphere is made up of gases and the hydrosphere is mostly liquid. The geosphere is mostly solid: it starts with the ground we walk on, the **ocean floor** and the **soil** under the ice in the Arctic and Antarctic Circles. It's divided into three layers: the **crust**, the **mantle** and the **core**.

- The crust is made up of solid **rock** and includes the continents, islands and ocean floor.
- The mantle is made up of liquid rock and semi-liquid rock called **magma**.
- The core is at the centre of the Earth. It's made up of liquid and solid iron, as well as other metals. We divide it into the outer core (liquid) and the inner core (solid).

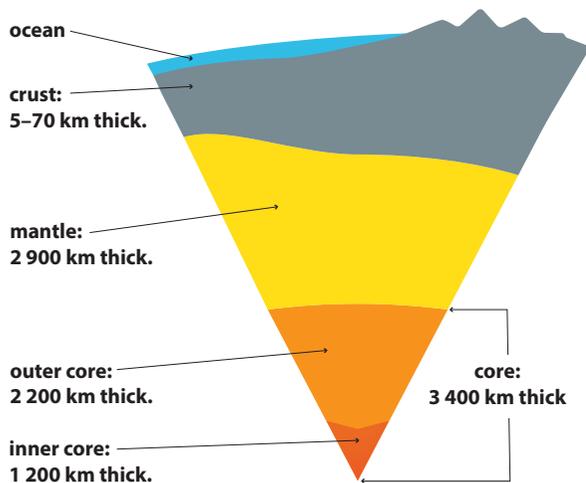


The temperature of the Earth's layers increases as we move towards the centre.

5 Read, look and answer the questions.

- Which layer of the geosphere is the thinnest?
- Which layers have got liquid rock?
- Which layer is the hottest?
- Which layer is just below the crust?
- Which layer has got a liquid and a solid part?
- Which layer is the coldest?

6 Play Guess the layer.



Comparative adjectives	It's	hotter / thicker / deeper	than the ...
Superlative adjectives		the hottest / thickest / deepest ... layer	



It's hotter than the mantle and it's thicker than the inner core.

Yes! Your turn!

The outer core!

WOW
The centre of the Earth is more than 6 000 km below its surface!

At home

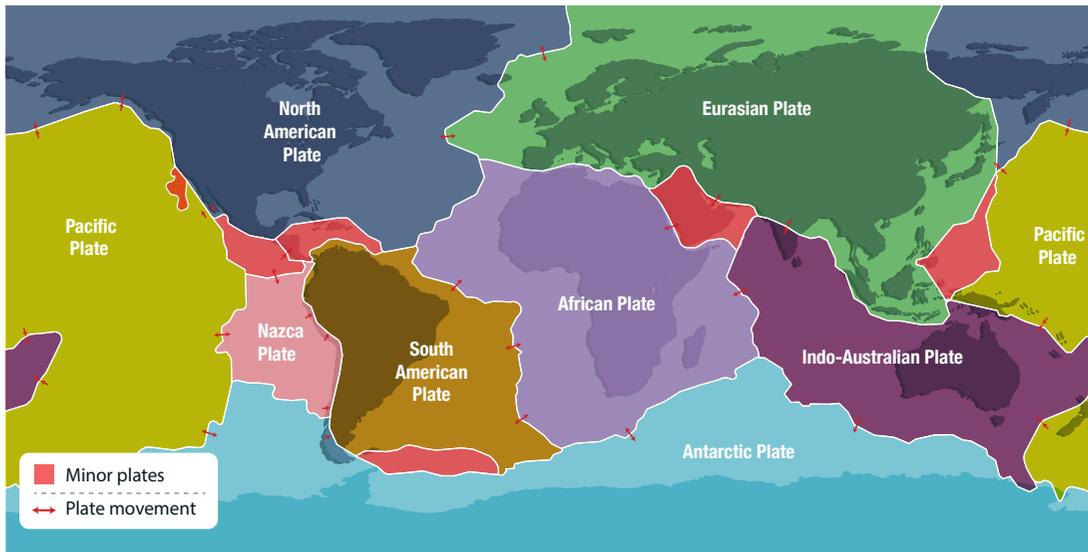
Write two sentences about the Earth's layers, one with a comparative adjective and one with a superlative adjective.

How are mountains formed?

The crust contains various **tectonic plates**. The movement of tectonic plates causes the formation of **mountain ranges** and other landforms.

Tectonic plates

The Earth's crust is like a giant puzzle: it's made up of different pieces that fit together. We call these pieces **tectonic plates**. Tectonic plates float on the semi-liquid mantle, so they don't stay still. They move very, very slowly and this movement is what created Earth's relief.

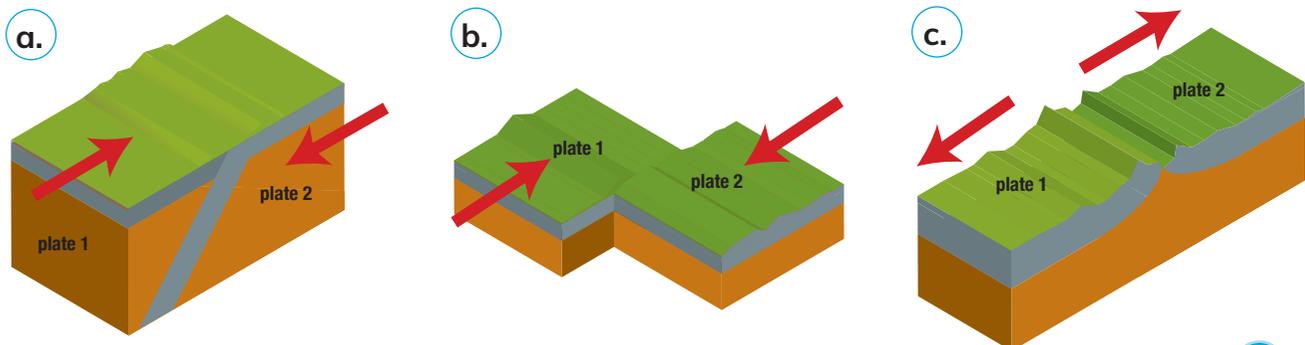


1 Look at the map, read and answer the questions in your notebook.

- Why don't tectonic plates stay still?
- Is the Nazca Plate moving towards the South American Plate or away from it?
- Is the African Plate moving towards the Indo-Australian Plate or away from it?

Some tectonic plates are **moving towards** the plate next to them and other tectonic plates are **moving away** from the plate next to them. There are also tectonic plates that are **moving past** the plate next to them.

2 Describe how the tectonic plates are moving in these diagrams.

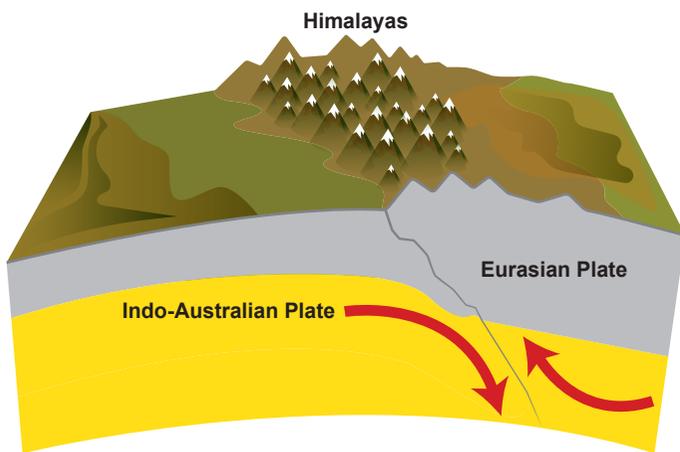


3 Look at the map. Listen and write which tectonic plate each student talks about.  003

Mountain formation

When two tectonic plates are moving towards each other, eventually they **collide**. One plate moves under the other, pushing the crust upwards. This is how mountain ranges form. It's a **constructive** process because new landforms are created.

In this diagram we can see how the Himalayas formed 50 million years ago, when the Indo-Australian Plate collided with the Eurasian Plate. The Indo-Australian Plate moved under the Eurasian Plate, pushing the crust upwards to form the Himalayas.



4 Look, read and answer the questions.

- Did the Himalayas form because two plates were moving towards each other or moving away from each other?
- Why do we call this a constructive process?
- In which countries are the Himalayas?

WOW

Mount Everest is the world's highest mountain. It's still growing because the Indo-Australian Plate is pushing the Eurasian Plate upwards.



Torres del Paine National Park in the Andes (Chile)

The Andes are another mountain range that formed because of tectonic-plate movement.

5 Work with a classmate to answer the questions.

- Use the Internet or a world physical map to find out where the Andes are.
- Look at the map on page 14. Which tectonic plates caused the Andes to form?
- Find out if the Andes are still growing.



At home

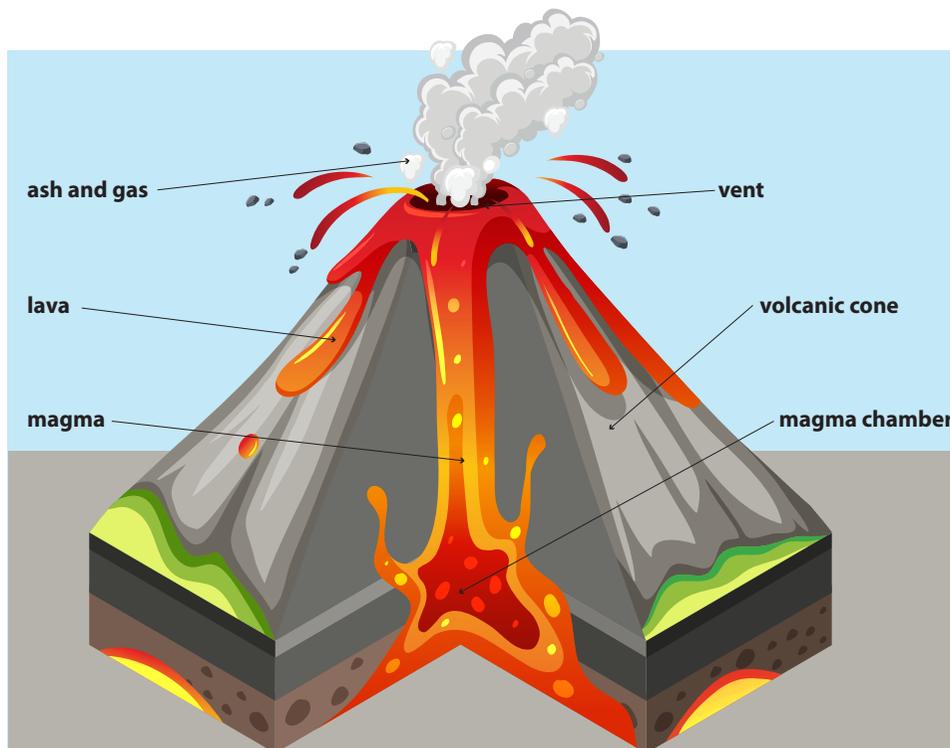
What's the highest mountain in your autonomous community?

What are volcanoes and how do they form?

A **volcano** can form when there's an opening in the Earth's crust. The movement of tectonic plates causes the formation of volcanoes.

1 Watch. What destroyed the city of Pompeii in 79 AD?

When there's an opening in the Earth's crust, magma can rise up from the mantle. If the magma reaches the Earth's surface, a **volcano** forms. This is an opening in the crust that allows explosions of very hot gases and liquid rock called **lava**. These explosions are called volcanic eruptions. The lava and **ash** from eruptions cool and accumulate on the ground around the volcano, forming a **volcanic cone**.



2 Look at the diagram. In your notebook, match the descriptions to the parts of the volcano.

- It's the opening that allows magma to rise to the surface.
- It's the semi-liquid rock below the Earth's surface.
- It's the landform created when material from a volcano accumulates on the ground.
- It's the semi-liquid rock that comes out of a volcano on to the Earth's surface.

3 Volcanoes can be active, dormant or extinct. Think about these words and match them to the definitions.

- | | |
|--------------------|---|
| a. active volcano | 1. Scientists think it will never erupt again. |
| b. extinct volcano | 2. Scientists think it will definitely erupt again. |
| c. dormant volcano | 3. Scientists think it could erupt again. |



Underwater volcano near El Hierro (Canary Islands)

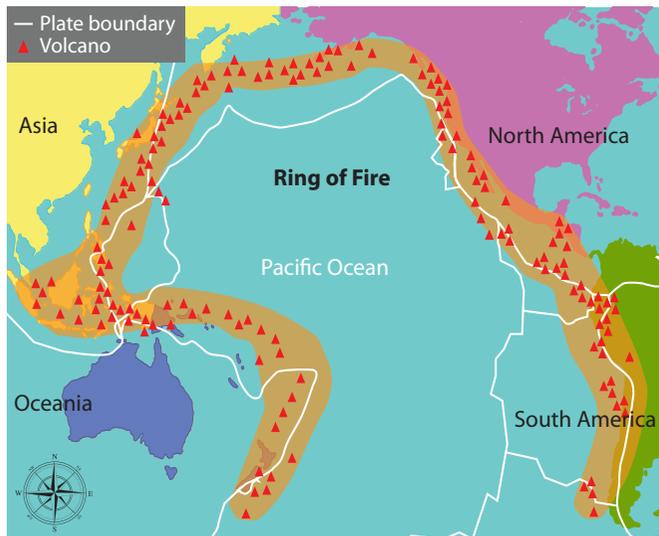
There are also **submarine volcanoes** on the ocean floor. In 2011, a submarine volcano erupted near El Hierro in the Canary Islands. The eruption lasted for 100 days.

4 Listen and answer the questions about submarine volcanoes.  **004**

- Name two landforms they create.
- What's the Mid-Ocean Ridge?
- Which Spanish archipelago was formed by volcanic activity?

Volcanoes usually occur where a tectonic plate meets another plate. These boundaries can be on the continents or under the ocean.

- When two plates are **moving away** from each other, this creates an opening for magma to rise up from the mantle and form a volcano.
- When two plates **move towards** each other and **collide**, one plate moves under the other. This plate starts to melt due to the pressure from the plate on top. The melting plate forms magma. High pressure can cause this magma to rise and form a volcano.



The Ring of Fire is line around the Pacific Ocean where there are many volcanoes.

5 With a classmate, look at the map and compare it with the map on page 14.

- Which tectonic plates meet in the Ring of Fire?
- What direction are they moving in?
- Why do you think it's called the Ring of Fire?

WOW

There are more than 400 volcanoes in the Ring of Fire!

6  **Look at the photos with a classmate. Do you think volcanoes cause constructive or destructive processes?**



At home

Find out when Mount Teide last erupted.

What are the effects of volcanoes and earthquakes?

Tectonic-plate movement can also cause **earthquakes**. Earthquakes and volcanoes both have destructive effects. However, volcanoes can also have constructive effects.

Earthquakes

An earthquake is a sudden and very violent **movement of the ground**. Earthquakes occur on the boundaries between tectonic plates. They're caused by a sudden release of energy that has accumulated in the crust. This energy is produced by **friction** as plates move past each other, or accumulates as plates try to move but get stuck.

The effects of volcanoes and earthquakes

This photo shows the consequences of an earthquake in Los Angeles (United States) in 1994. Many people died and many more were injured. The earthquake destroyed motorways, cars, buildings and houses.



1 Find Los Angeles on a world map. Look at the map on page 14 and answer the questions.

- Which two plates meet near Los Angeles?
- How do these plates move?
- Why does this movement cause earthquakes?

When a volcano erupts, very hot gases and ash are ejected into the air, and lava flows over the ground. Volcanoes have got some **constructive effects**. For example, soil formed from volcanic materials is very fertile for agriculture. We can use magma that rises through the crust to generate geothermal energy. However, the hot gases, ash and lava from volcanic eruptions have also got many **destructive effects**.

2 In your notebook, match the captions to the photos.

a. Gases and ash cause respiratory problems.

b. The flow of hot lava can cause fires.

c. Lava and ash destroy landscapes and buildings.



How do water and wind affect the Earth's relief?

Erosion is continuously modifying the Earth's surface. It's caused by the destructive action of water and wind.

The size and shape of Earth's landforms don't stay the same over time because of **erosion**. Erosion is the slow destruction of landforms and soil. It's caused by the natural action of **water** and **wind**. In addition, water and wind can also create new landforms.

The action of water

Water causes erosion because its movement gradually breaks down or dissolves rock.

Rivers create **valleys** because the flowing water erodes the rock along the riverbank. In the upper course, the valley usually has a V-shape because the water flows very fast. This causes stronger erosion. In the middle and lower course, the water flows more slowly, so the valley is wider and its sides are less steep.

- 1 Read and look at the photo. Do you think this valley was created by fast or slow flowing water? Why?



The action of salt water also causes erosion on the coast. When waves hit the rock, they create **cracks** in it and pieces of rock eventually break off. **Cliffs** and **bays** are examples of landforms created by the movement of the sea. The shape and size of these landforms also depend on the type of rock. Erosion happens more quickly when the coastline is made of soft rock, such as chalk. It happens more slowly when the coastline is made of hard rock, such as granite.

- 2 Read and look at these photos. Then answer the questions in your notebook.

- a. Describe the differences between the landforms.
- b. Which coastline is made of a harder rock? Explain how you know.



White Cliffs of Dover (UK)



Las Catedrales Beach (Galicia)

Water also affects the **soil**. If it falls on the surface or moves across it, water can wash the soil away. This causes **soil erosion**.



3 Look at the photo and answer the questions.

- Where does the water flowing down the riverbank come from?
- What colour is this water? Why?
- What do you think might happen to the plants growing on the riverbank?

4 **5** Look at the photos and answer the questions with a classmate.



- How do you think the trees prevented erosion in photo 2?
- How could we stop more erosion happening in photo 1?

The action of wind

Wind causes erosion because it transports small grains of **sand**. It blows these grains of sand against rock, causing pieces of rock to eventually break off. This erosion changes the shape of landforms. Wind can also create new landforms by depositing grains of sand on the ground. For example, these accumulate and form **sand dunes** in coastal areas and in the desert.

5 Look at the photos and match the landforms to the descriptions.

- The wind blew grains of sand against the rock, causing erosion. This changed the shape of the landforms.
- The wind deposited grains of sand on the ground. This created new landforms.



Desert sand dunes



Yardangs



How important is movement in erosion?

We know that water erodes rock to create landforms both inland and on the coast, but how important are speed and movement in this process? We can test this using chalk, a type of rock that's easy to find.

Hypothesis

Is there a difference in the speed of erosion if water is moving faster or more slowly? Write your hypothesis.

Materials

- digital scales
- 2 pieces of chalk
- water
- 2 pots with lids labelled 1 and 2
- timer



Step 1

Work with a classmate. Half fill the pots with water. Weigh a piece of chalk and write down the weight in a table.



Step 2

Put the chalk in pot 1 and put the lid on. Then weigh another piece of chalk and repeat the process for pot 2.



Step 3

Start the timer. Person A moves pot 1 slowly from side to side for five minutes. Person B shakes pot 2 at a faster speed for five minutes.



Step 4

Remove the chalk from pot 1, weigh it and write down the weight. Repeat for pot 2. Compare the weights with the original ones.

Results

▶ Watch. Compare your results with your classmates. Fill in the worksheet. [↓](#)

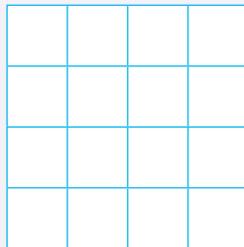
Tip 1

Identifying cognates

Cognates are words in two languages that share a similar meaning and spelling.

1 Play Cognates four in row with a classmate.

- Draw a 16-square grid in your notebook.
- Find eight words in this unit that are cognates in your language and eight words that aren't.
- Write a word in each square of your grid.
- Play *Four in a row* with a classmate. Take turns to select a word from your classmate's grid. Say if it's a cognate and explain what it means. If you're correct, mark a cross on the square.
- The winner is the first to have four crosses in a row.



Tip 2

Relative pronouns

We use relative pronouns to connect a noun to other words that give us more information about it.

2 Join these sentences together using *which*, *when* or *where*.

- The Ring of Fire is a large area in the Pacific Ocean. There are many volcanoes there.
- The hydrosphere is all the water on Earth. It includes both salt water and fresh water.
- Volcanoes often occur at tectonic-plate boundaries. Tectonic-plate boundaries can be on the continents or under the ocean.
- The Himalayas formed 50 million years ago. Two tectonic plates collided.
- A volcano is an opening in the crust. It allows lava to flow on to the Earth's surface.

Tip 3

Teach the class

3 Work in small groups to teach the class about a topic.

the Earth's layers

tectonic plates

volcanoes and earthquakes

erosion

I'm going to talk about how erosion shapes landforms.



- Choose one of these topics and write what you can remember. Decide how to order the information and make a presentation.
- Teach your topic to the rest of the class. Try to answer any questions they ask you.

Story

1  Read and listen.  006

2 Find the words in the story.

landforms

earthquake

eruption

tectonic plates

river

What a planet!

Eric and Malika are doing their science homework. Eric isn't feeling very motivated.

I have to write an essay about the Earth and I don't know where to start.

I've got an idea. Let's use your magic machine!

Eric has got a magic machine that he invented. It can travel through time and space.

If we visit different places on Earth, maybe you'll get inspiration for your homework.

What a great idea!

Landforms are the natural features of the Earth's surface. They form through different processes.

Look at that valley, Eric. How do you think it formed?

That's right!

Errr, maybe it was the river?

Tectonic-plate movement created the landforms on the continents and on the ocean floor.

Wow! There are even mountains under the ocean!!!!

Yeah! They were formed when two tectonic plates collided, millions of years ago.

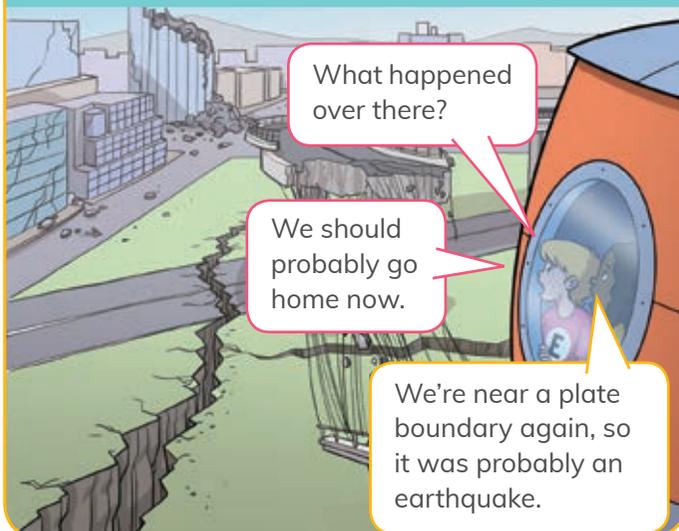
The Eurasian and Indo-Australian Plates collided 50 million years ago. The Eurasian Plate rose up and formed the Himalayas.



Volcanoes often occur at tectonic-plate boundaries, when plates are moving towards each other or away from each other.



Earthquakes happen on tectonic-plate boundaries when there's a sudden release of energy caused by plate movement.



Malika and Eric are on the way home. Eric still has to finish his homework, but he's feeling more confident after everything he's seen.



3 Are the sentences true or false? Correct the false sentences in your notebook.

- Initially Eric is very confident about starting his science homework.
- Mountain ranges were formed when tectonic plates collided.
- The landforms we can see today were formed millions of years ago.
- Iceland isn't near a tectonic-plate boundary.
- Earthquakes happen when magma from the mantle escapes on to the Earth's surface.
- Eric's house is on top of a tectonic-plate boundary.

Inge Lehmann



Inge Lehmann was born in Copenhagen, Denmark in 1888. She went to a secondary school which treated boys and girls equally. This was very unusual at that time. She studied physics, mathematics and chemistry at the University of Copenhagen. Seismology was a new field of study in the early 20th century. It studies earthquakes and the waves of energy that travel through the Earth. Inge Lehmann began to study seismology in the 1920s and she established seismological observatories in Denmark.

At the time, seismologists believed that the Earth's core was liquid. In 1936 Inge Lehmann was the first seismologist to demonstrate that

the inner core is solid. Others accepted her theory, and more than 30 years later, computer calculations showed that she was correct.



A seismograph

1 Answer the questions in your notebook.

- Which century was Inge Lehrman born in?
- What was unusual about her secondary school?
- What did she study at university?
- What's seismology?
- What important discovery did Inge Lehrman make in 1936?
- What type of machine showed that Inge Lehrman's calculations were correct?

WebQuest



2 This is James Hutton. When you finish your WebQuest, answer the questions in your notebook.

- Why's James Hutton famous?
- When was he born?
- Where was he born?
- Where did he study?
- What's the name of his main theory?
- Did he believe the Earth was 6 000 years old?





Challenge

Can you make a model of a volcanic eruption?

Before you start

You're going to make a model of a volcanic eruption using everyday objects and ingredients.

- 1 Answer the questions in small groups.
 - a. Where do volcanoes form?
 - b. What happens when a volcano erupts?



You need ...

- baking soda
- bowl
- 500 ml plastic bottle
- small pot
- sheet of brown A3 card
- sheet of green A3 card
- red food colouring
- scissors
- tablespoon
- tape
- vinegar
- washing-up liquid
- water



Planning

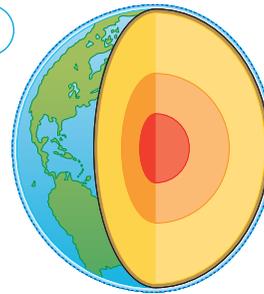
- 2 Put the plastic bottle upside down on the brown card and trace a circle around the top of the bottle. Cut the card in a straight line from the edge to the centre of the circle. Cut out the circle. Form a cone with the card and stick the straight edges with tape.
- 3 Turn the bottle the right way up and place it on the green card. Put the brown cone on top of the bottle. Cut any excess brown card and tape the bottom of the cone to the green card. Tape the top of the cone to the top of the bottle.
- 4 Put two tablespoons of baking soda, two tablespoons of washing-up liquid and four tablespoons of water in the bowl. Mix together and then pour it into the bottle.
- 5 Mix 16 tablespoons of vinegar and 1 tablespoon of food colouring in the small pot.
- 6 Add the vinegar mixture to the bottle and watch your volcano erupt!
- 7  You can repeat using smaller or larger quantities of baking soda and vinegar to see what happens to the eruption.
- 8 Join another group. Tell them what happened when you change the quantities of the ingredients.



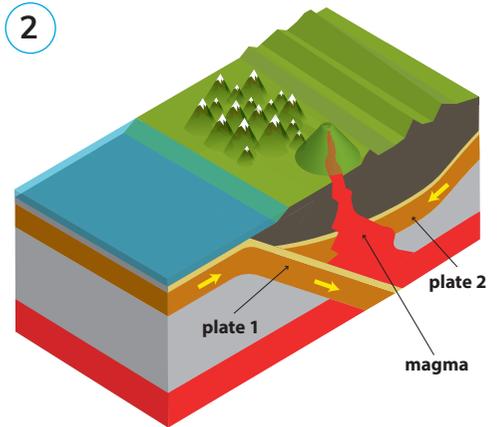
1 Answer the questions in your notebook.

- a. Copy diagram 1 and label the Earth's layers.
- b. Which layer is made up of magma?
- c. Which layer is the hottest?
- d. What are tectonic plates?
- e. Describe three ways tectonic plates can move.
- f. Look at diagram 2. Describe what's happening. What landform has tectonic-plate movement created here?
- g. What do we call a sudden and violent movement of the ground?
- h. Where does this happen and what effects can it cause?

1



2



2 Copy and complete the sentences. Use the words from the boxes.

movement

volcanic eruptions

earthquake

erosion

sand dunes

- a. The Richter Scale measures the size of an .
- b. Hot gases and ash from can cause respiratory problems.
- c. is the slow destruction of landforms through the action of water and wind.
- d. Some coastal landforms, such as cliffs and bays, are created by the of the sea.
- e. are created by the wind. The wind also changes the shape of landforms by blowing grains of sand against rock.

3 Write a sentence about each of these topics.

- a. the layers of the Earth
- b. tectonic-plate movement
- c. how mountains form
- d. volcanoes
- e. the effects of volcanic eruptions and earthquakes
- f. erosion

4 Do the quiz!



Reflect

1 Read the unit objectives and say what you have learned. Write one thing you can do and one thing you need more practice with.

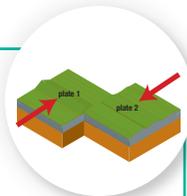
I can ...

identify the Earth's spheres and layers.



I can ...

explain what tectonic plates are and how they move.



I can ...

describe how tectonic-plate movement forms mountain ranges.



I can ...

identify the parts of a volcano and explain where and how volcanoes form.



I can ...

talk about the effects of volcanic eruptions and earthquakes.



I can ...

explain how the action of water and wind creates and shapes landforms.



I can ...

explain who Inge Lehrman was.



I can ...

use the Internet to research James Hutton.



I can ...

make a model of a volcanic eruption.



Key:

- I'm not sure.
- I need some practice.
- I understand.

2 Make a poster about one of these topics.

landforms we find at tectonic-plate boundaries

constructive and destructive effects of volcanoes

how erosion shapes landforms