

# My First Library of Knowledge

# Our Planet Earth



 Orpheus

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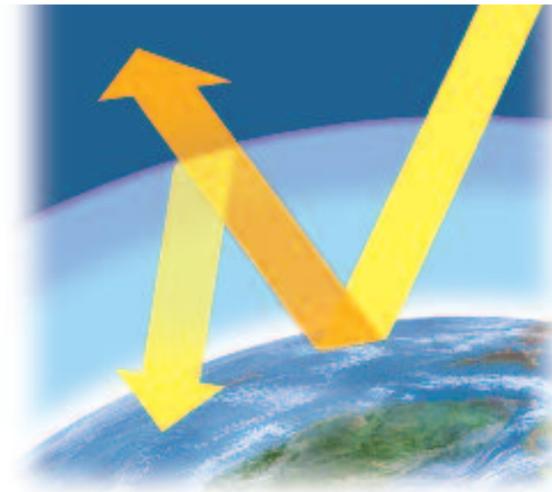
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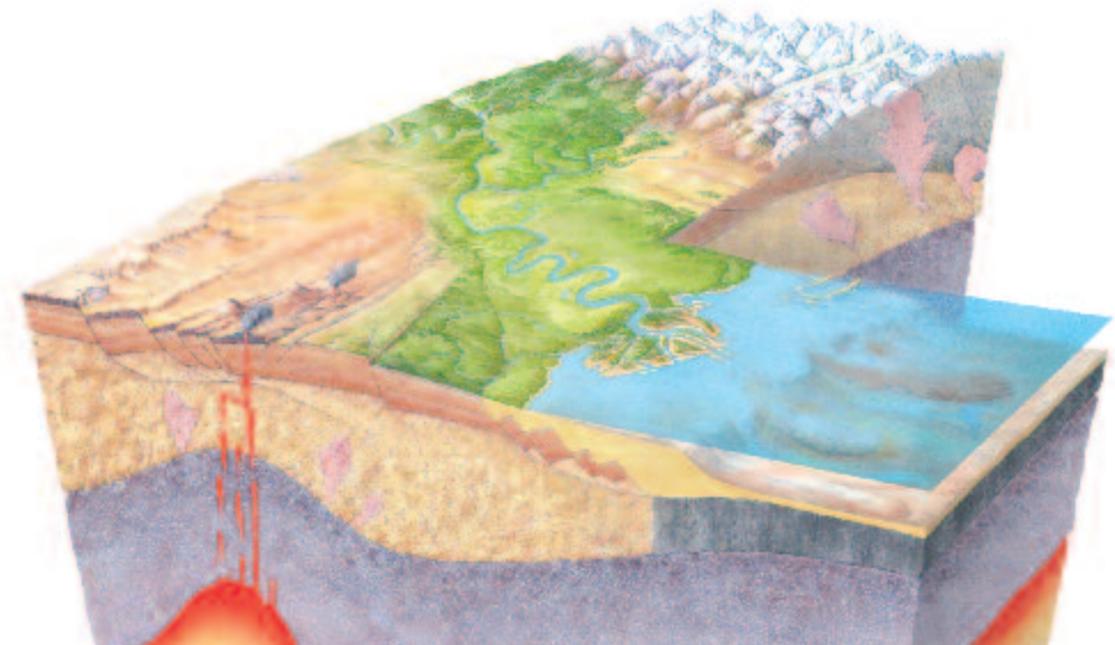
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# INTRODUCTION

**T**HE EARTH is a huge, spinning ball of rock. It is one of nine planets that travel round the Sun. It is the only world we know where life exists. Its surface is made up of oceans, which cover more than two thirds of it, and land masses, called continents. A layer of air called the atmosphere, surrounds the Earth.



## INSIDE THE EARTH

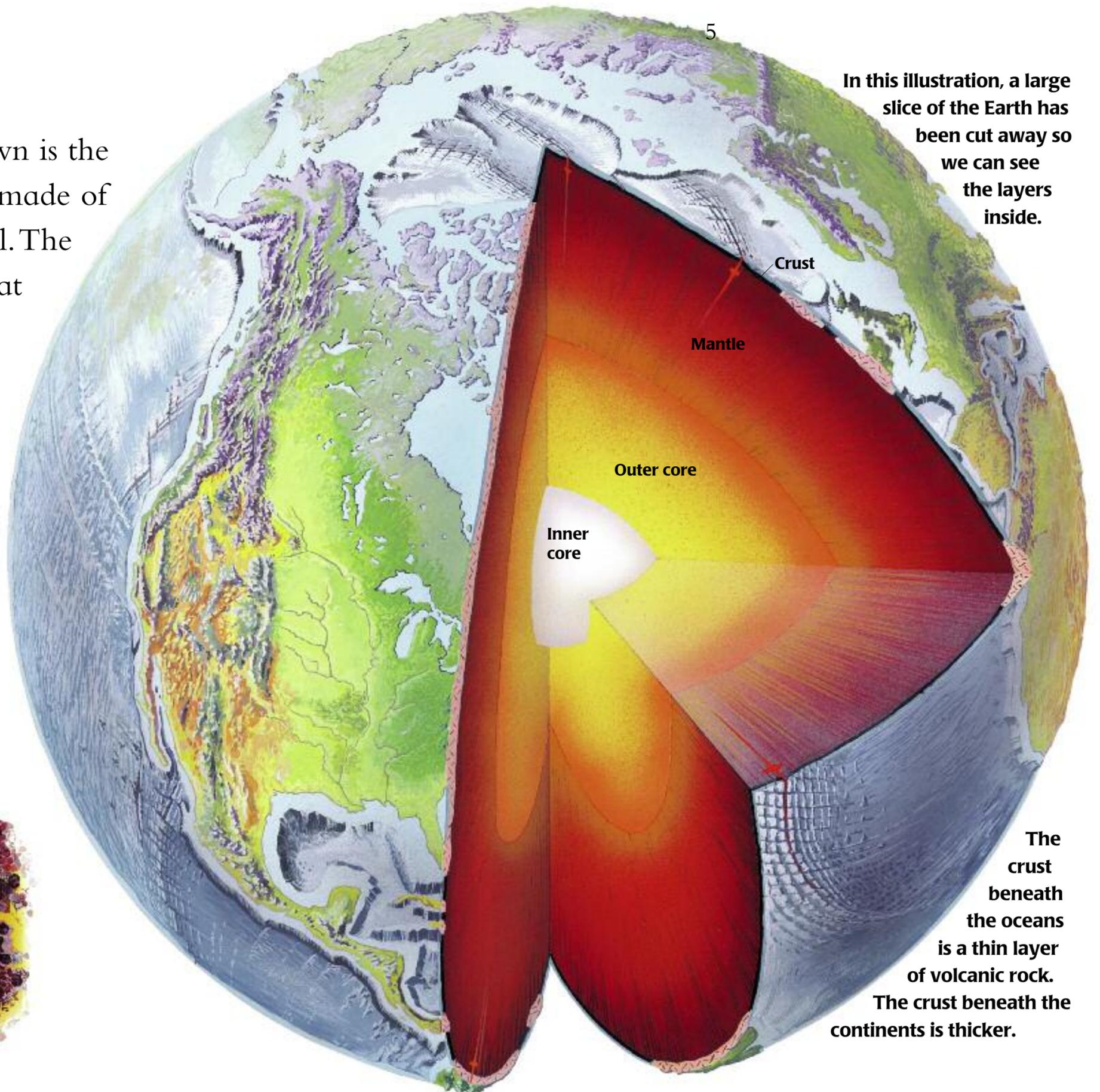
**T**HE EARTH has a thin rocky shell on the outside, called the crust. Beneath lie several layers, all extremely hot. The first layer, the mantle, is made of rocks so hot they have partly melted.

### MAGMA

In the mantle, the temperature is 2000°C. Here, the rock is partly melted. Known as magma, it flows like hot tarmac on a newly-surfaced road. Sometimes the magma is forced upwards from the mantle. It can burst through weak points in the Earth's crust. It erupts at the surface in a volcano.



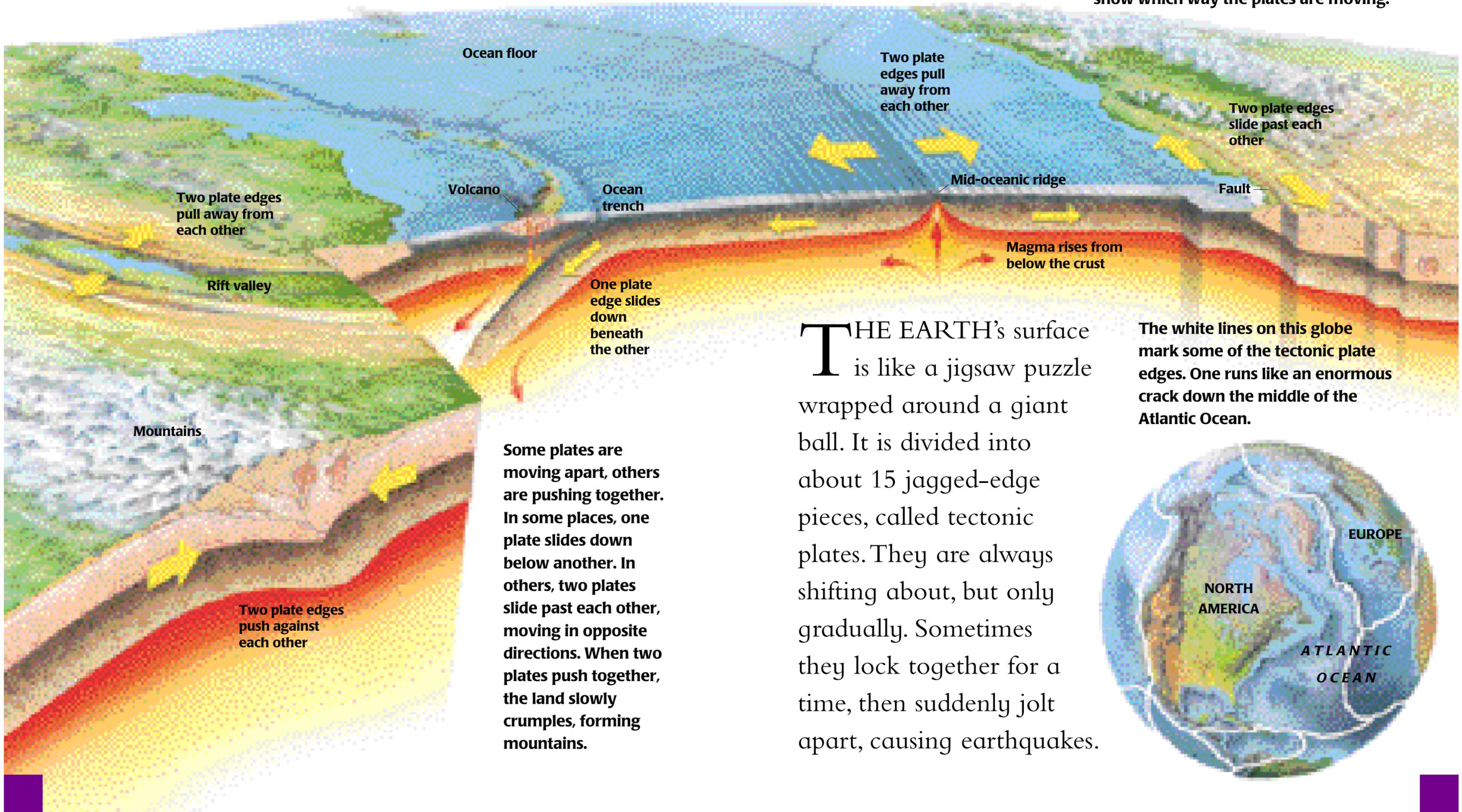
Farther down is the outer core, made of liquid metal. The inner core, at the Earth's centre, is a solid ball of iron.



In this illustration, a large slice of the Earth has been cut away so we can see the layers inside.

The crust beneath the oceans is a thin layer of volcanic rock. The crust beneath the continents is thicker.

# TECTONIC PLATES



This diagram is a cross-section through the Earth's crust. The yellow arrows show which way the plates are moving.

Some plates are moving apart, others are pushing together. In some places, one plate slides down below another. In others, two plates slide past each other, moving in opposite directions. When two plates push together, the land slowly crumples, forming mountains.

**T**HE EARTH's surface is like a jigsaw puzzle wrapped around a giant ball. It is divided into about 15 jagged-edge pieces, called tectonic plates. They are always shifting about, but only gradually. Sometimes they lock together for a time, then suddenly jolt apart, causing earthquakes.

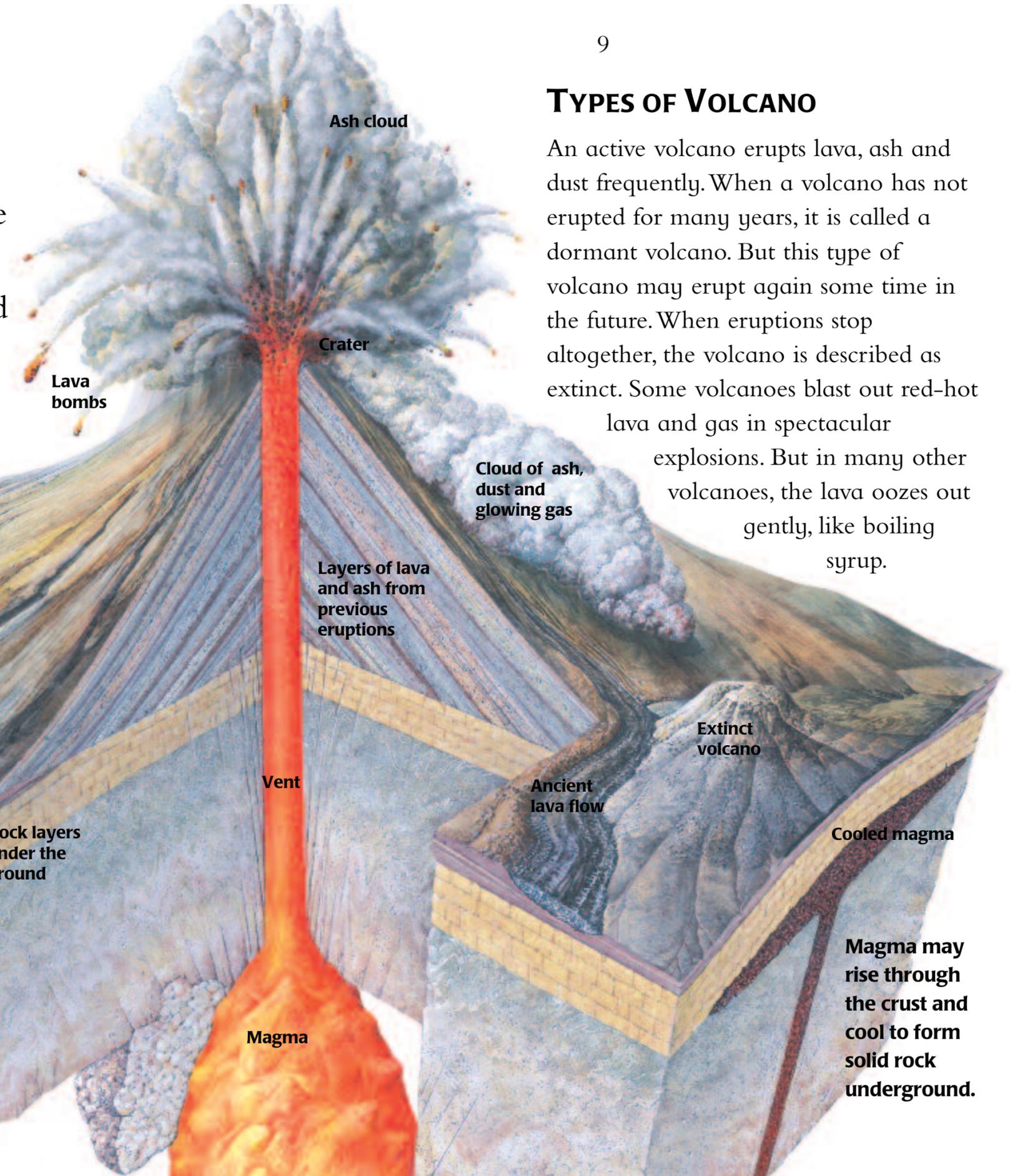
The white lines on this globe mark some of the tectonic plate edges. One runs like an enormous crack down the middle of the Atlantic Ocean.



# VOLCANOES

**A** VOLCANO is an opening in the Earth's crust through which magma erupts. Many volcanoes are cone-shaped mountains with a crater at the

summit. In a violent eruption, the volcano shoots huge amounts of lava (erupted magma), ash and dust into the air. Over time, many layers of lava and



Magma seeps through gaps between the rock layers to form sheets of volcanic rock.

Dormant volcano

Rock layers under the ground

Magma

Vent

Layers of lava and ash from previous eruptions

Cloud of ash, dust and glowing gas

Ancient lava flow

Extinct volcano

Cooled magma

Magma may rise through the crust and cool to form solid rock underground.

## TYPES OF VOLCANO

An active volcano erupts lava, ash and dust frequently. When a volcano has not erupted for many years, it is called a dormant volcano. But this type of volcano may erupt again some time in the future. When eruptions stop altogether, the volcano is described as extinct. Some volcanoes blast out red-hot lava and gas in spectacular explosions. But in many other volcanoes, the lava oozes out gently, like boiling syrup.

# EARTHQUAKES

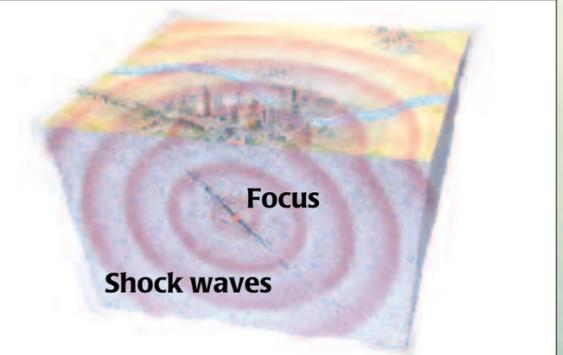
**A**N EARTHQUAKE is the trembling or shaking of the ground. It is caused by the sudden movement of the rocks in the Earth's crust. This happens when the edge of

one tectonic plate (*see page 6*) slides beneath or alongside another. The two plates may lock together for a while before the pressure becomes too much and the rocks snap apart.



## EARTHQUAKE DAMAGE

It is most likely in towns and cities where earthquakes cause large loss of life. The sudden violent shaking of the ground may result in the collapse of buildings and bridges, pipes bursting and cables breaking. Fire or flooding also create great damage.



## SHOCK WAVES

The place where the rocks snap is called the focus. Shock waves travel out in all directions. In a small earthquake, the ground will tremble only slightly. In a large one, it may shake violently for several minutes.



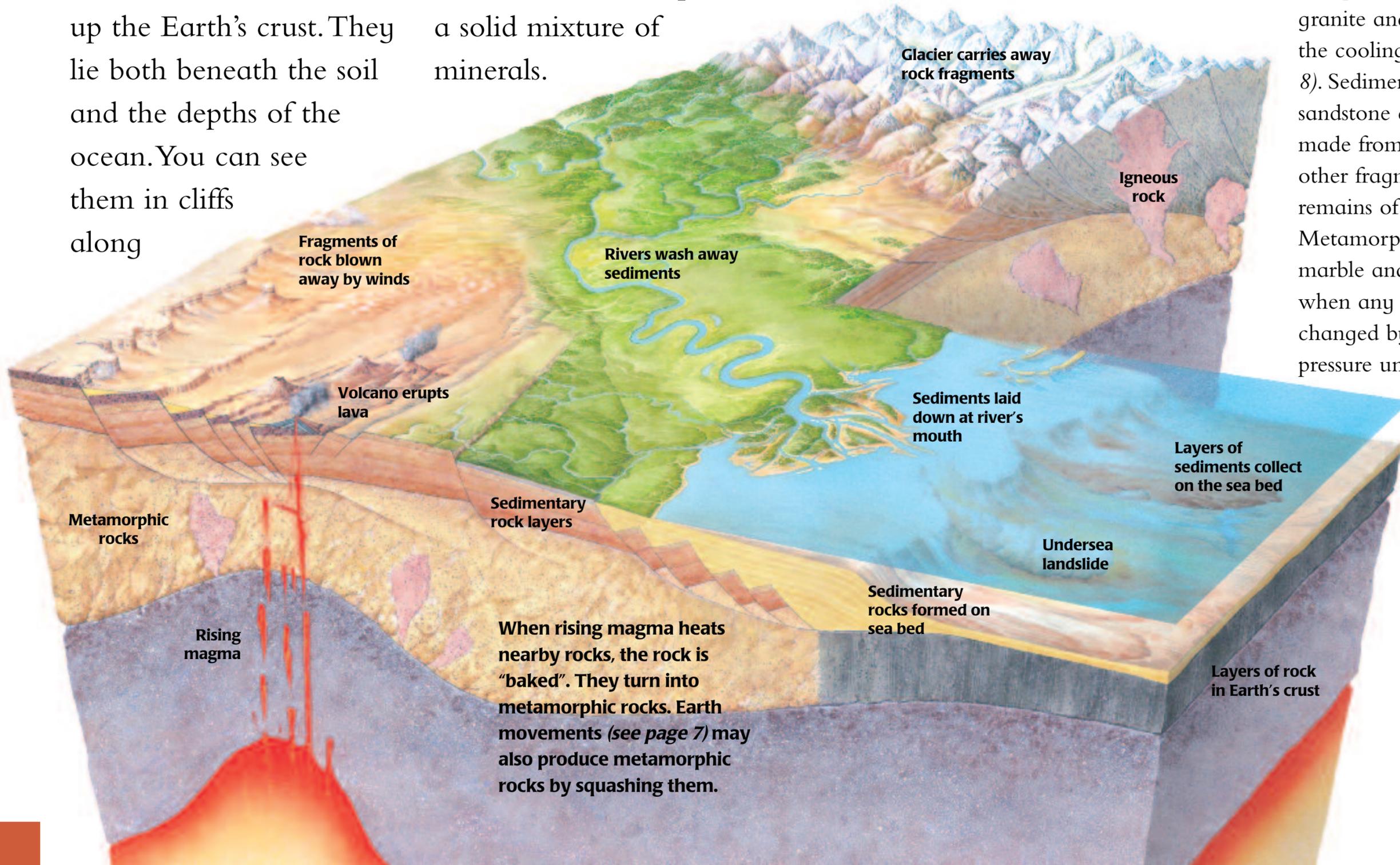
## TSUNAMI!

A tsunami is caused by an earthquake on the sea bed. The sudden slip creates a series of fast-moving waves. When they reach coastal waters, they build up to immense heights.

# HOW ROCKS ARE MADE

**R**OCKS are the hard materials that make up the Earth's crust. They lie both beneath the soil and the depths of the ocean. You can see them in cliffs along

the seashore. Rocks are, themselves, made up from a solid mixture of minerals.



When rising magma heats nearby rocks, the rock is "baked". They turn into metamorphic rocks. Earth movements (see page 7) may also produce metamorphic rocks by squashing them.

# TYPES OF ROCK

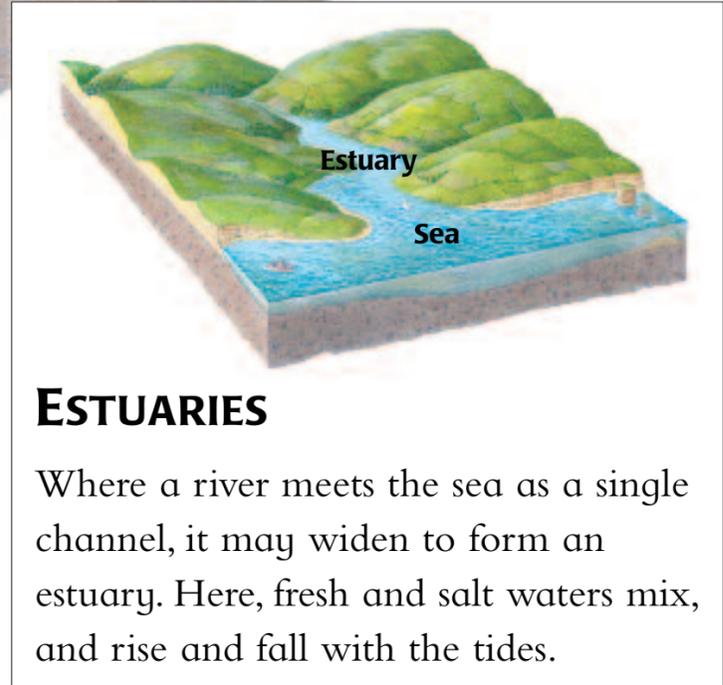
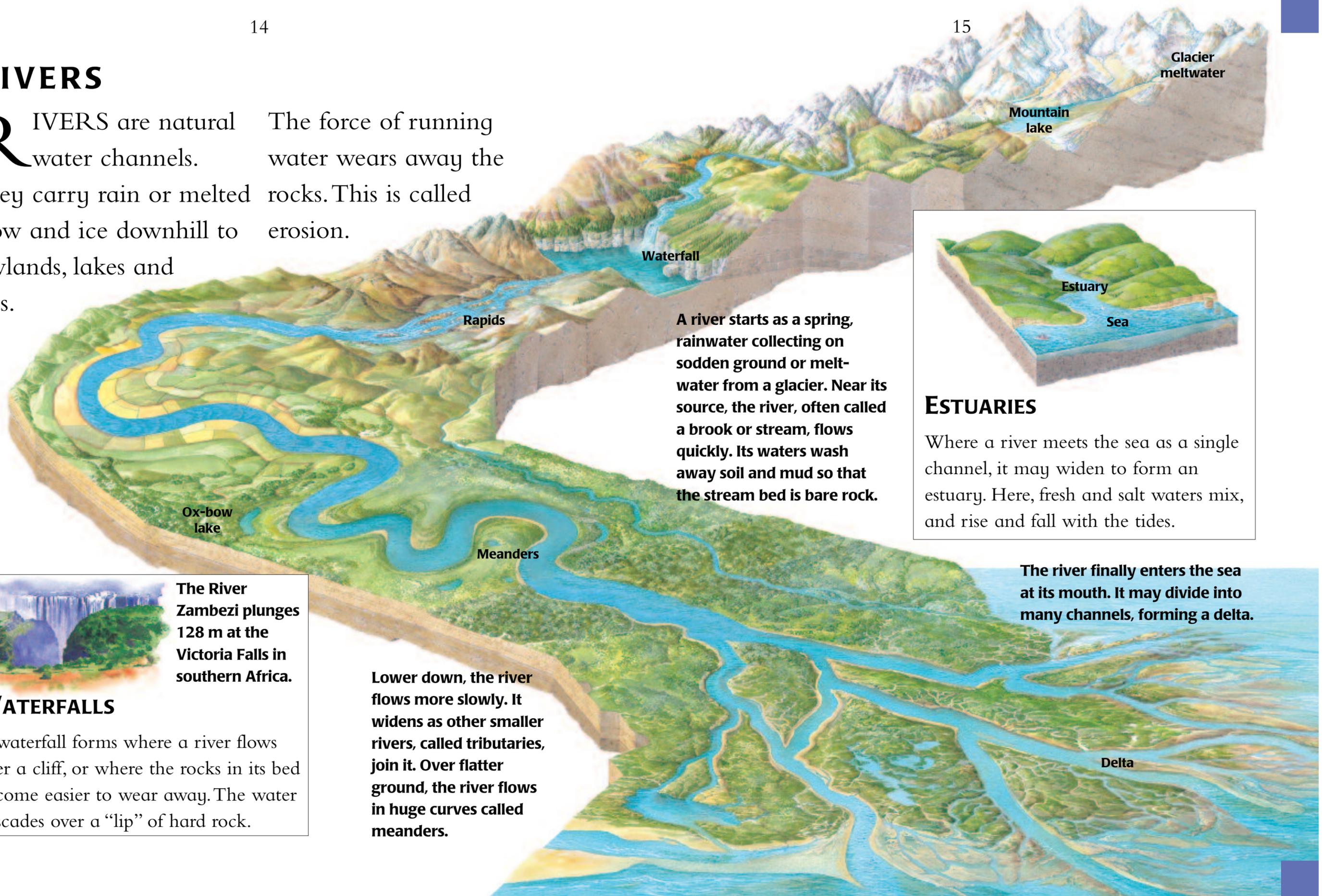
There are many kinds of rocks. They can be divided into three groups. Igneous rocks, such as granite and basalt, result from the cooling of magma (see page 8). Sedimentary rocks, such as sandstone and limestone, are made from sand, mud and other fragments of rock, or the remains of living things. Metamorphic rocks, such as marble and slate, are formed when any kind of rock is changed by great heat or pressure under the ground.

Many sediments are washed out to sea. As more layers settle on top of each other, the weight presses the fragments together. Eventually, they form rocks. Over millions of years, Earth movements may bring the sedimentary rock layers to the surface.

# RIVERS

**R**IVERS are natural water channels. They carry rain or melted snow and ice downhill to lowlands, lakes and seas.

The force of running water wears away the rocks. This is called erosion.



## ESTUARIES

Where a river meets the sea as a single channel, it may widen to form an estuary. Here, fresh and salt waters mix, and rise and fall with the tides.



**The River Zambezi plunges 128 m at the Victoria Falls in southern Africa.**

## WATERFALLS

A waterfall forms where a river flows over a cliff, or where the rocks in its bed become easier to wear away. The water cascades over a “lip” of hard rock.

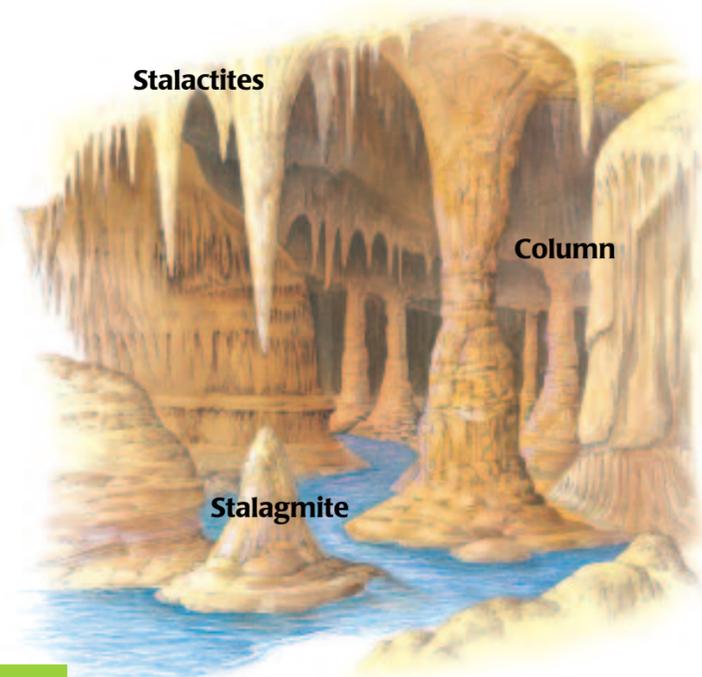
Lower down, the river flows more slowly. It widens as other smaller rivers, called tributaries, join it. Over flatter ground, the river flows in huge curves called meanders.

The river finally enters the sea at its mouth. It may divide into many channels, forming a delta.

Delta

# CAVES

**C**AVES are formed when water, flowing below ground, hollows out the rocks. You may also come across caves at the seashore, where waves crash against the cliffs. Limestone caves are often made up of a series of chambers, linked by tunnels and shafts. Some have lakes.

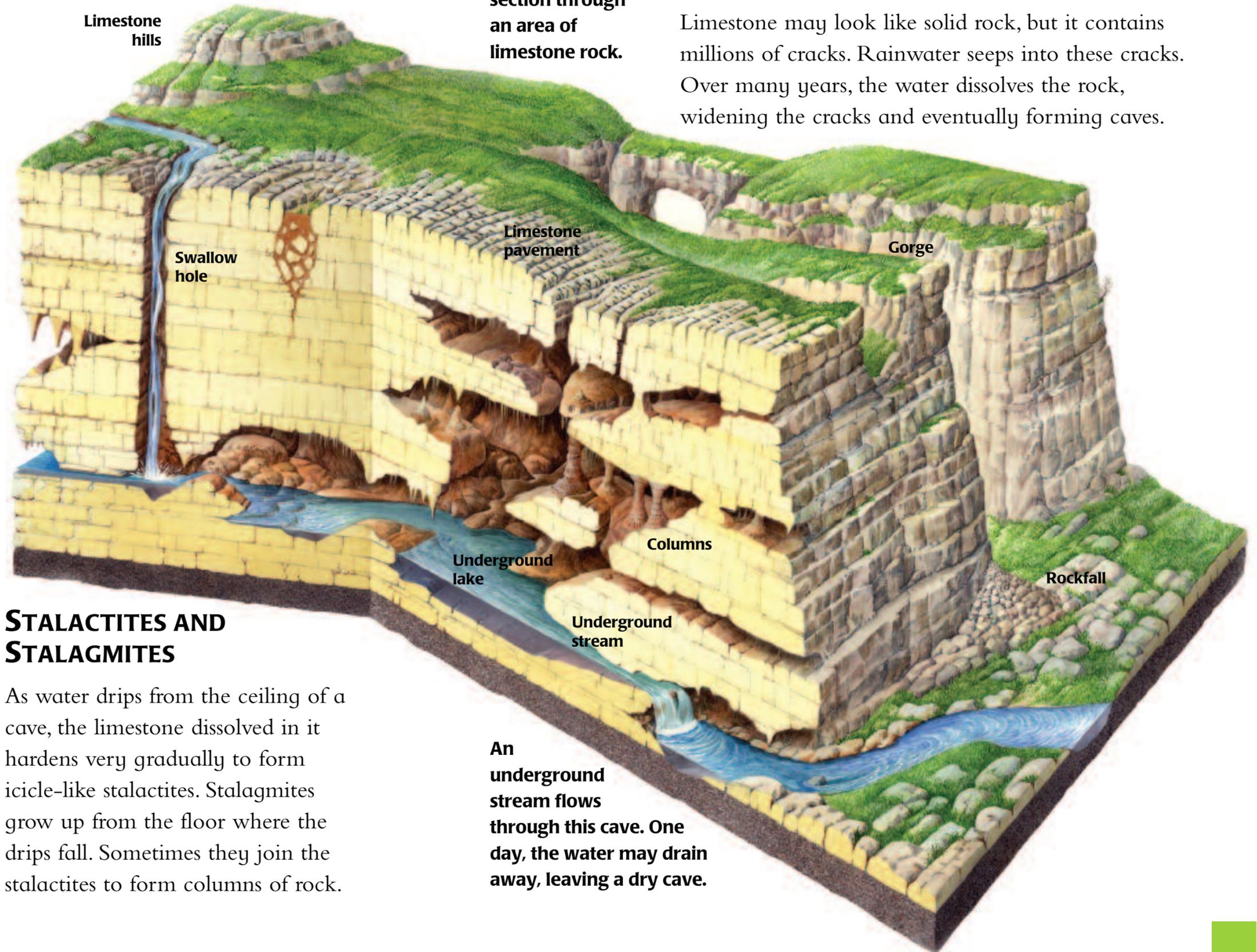


## STALACTITES AND STALAGMITES

As water drips from the ceiling of a cave, the limestone dissolved in it hardens very gradually to form icicle-like stalactites. Stalagmites grow up from the floor where the drips fall. Sometimes they join the stalactites to form columns of rock.

# LIMESTONE CAVES

Limestone may look like solid rock, but it contains millions of cracks. Rainwater seeps into these cracks. Over many years, the water dissolves the rock, widening the cracks and eventually forming caves.



This is a cross-section through an area of limestone rock.

An underground stream flows through this cave. One day, the water may drain away, leaving a dry cave.

## GLACIERS

**A** GLACIER is a mass of ice that moves slowly downhill. It is made from layers of snow.

As the layers build up, the snow turns to ice. The ice becomes so thick and heavy, it starts to move.

## RIVERS OF ICE

As a glacier grinds its way down a valley, it gouges out loose rocks and carries them downhill. These rocks collect together in bands called moraines. Where two glaciers meet, their moraines

merge together. Further down the valley where the glacier melts (at its snout), all the rocks are dumped in heaps known as end moraines. Where a glacier runs over steeper slopes, cracks, known as crevasses, form on its surface.

Cirque (hollow where glaciers begin)

Moraines from two glaciers meet

Crevasses (cracks in glacier)

Glacier

Snout

End moraine

End moraine

Meltwater streams



# DESERTS

Some desert mountain ranges have flat tops. They are called mesas.

Mesa

Wadi

Rock arch

When rainstorms do occur, the fast-flowing water quickly wears away the rocks to form steep-sided gorges called wadis.

Mushroom-shaped rocks

Salt flat

**D**ESERTS are found in areas where very little rain falls. Other than at oases, fertile spots in a desert, there is little sign of life. Many people think of deserts as vast areas of

sand. In fact, only about a fifth of the world's hot deserts are sandy. Most are just bare rock and gravel. Antarctica is also a desert: very little snow ever falls there.

Barchans

Where the wind always blows in the same direction, it piles up sand in crescent-shaped dunes, called barchans.

Oasis

Sand dunes

In deserts, strong winds may blast tiny sand particles at the rocks, carving out some incredible shapes. In some desert landscapes you can see rock arches. Mushroom-shaped rocks are made when wind-blown sand blasts away at the base of a boulder, leaving a narrow neck.

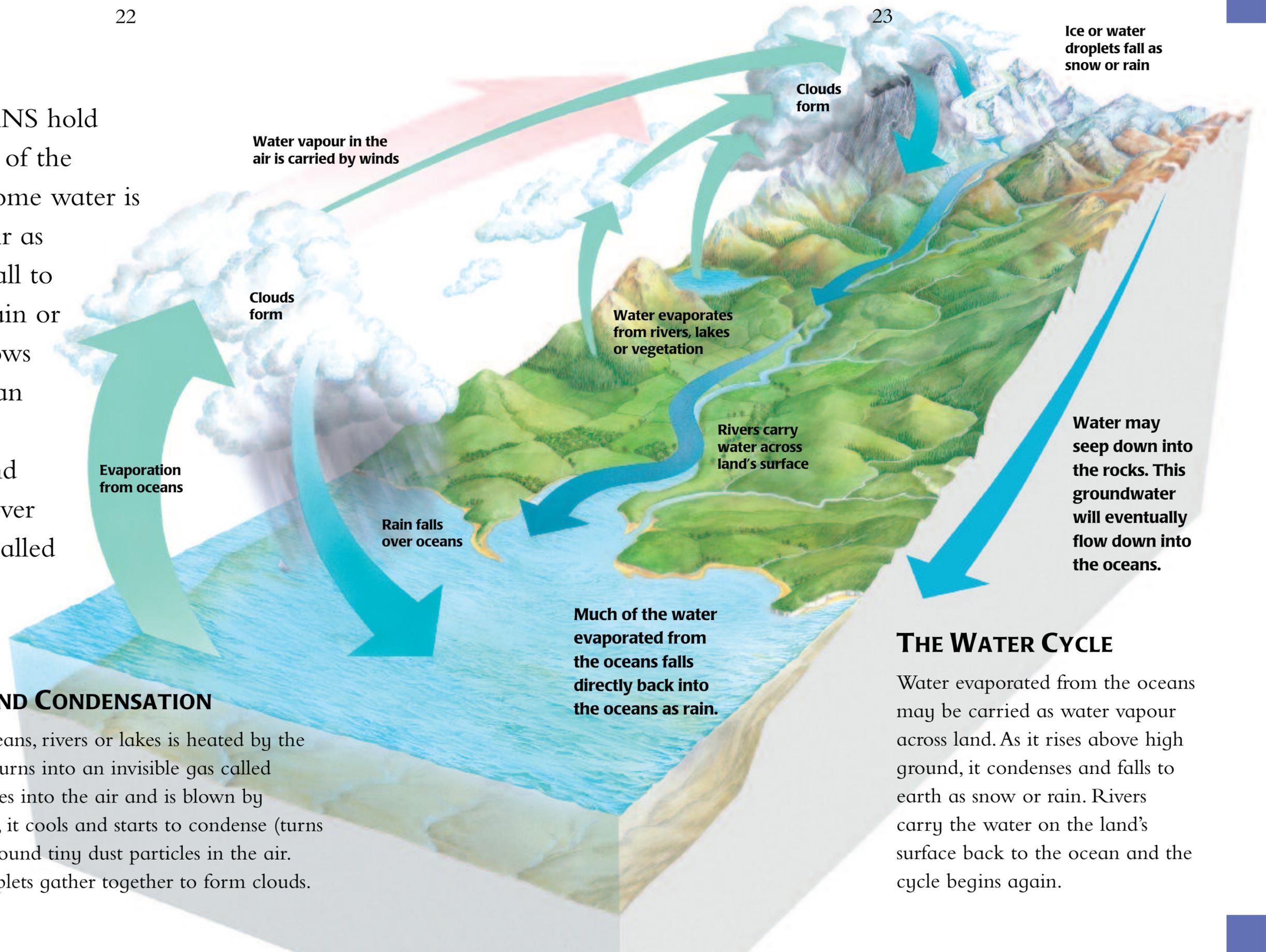


# WATER

**T**HE OCEANS hold about 97% of the world's water. Some water is carried in the air as clouds. It may fall to the ground as rain or snow. Then it flows back to the ocean in rivers. This happens over and over again, all over the world. It is called the water cycle.

## EVAPORATION AND CONDENSATION

When water from oceans, rivers or lakes is heated by the Sun, it evaporates: it turns into an invisible gas called water vapour. This rises into the air and is blown by winds. As the air rises, it cools and starts to condense (turns back into a liquid) around tiny dust particles in the air. Millions of water droplets gather together to form clouds.



## THE WATER CYCLE

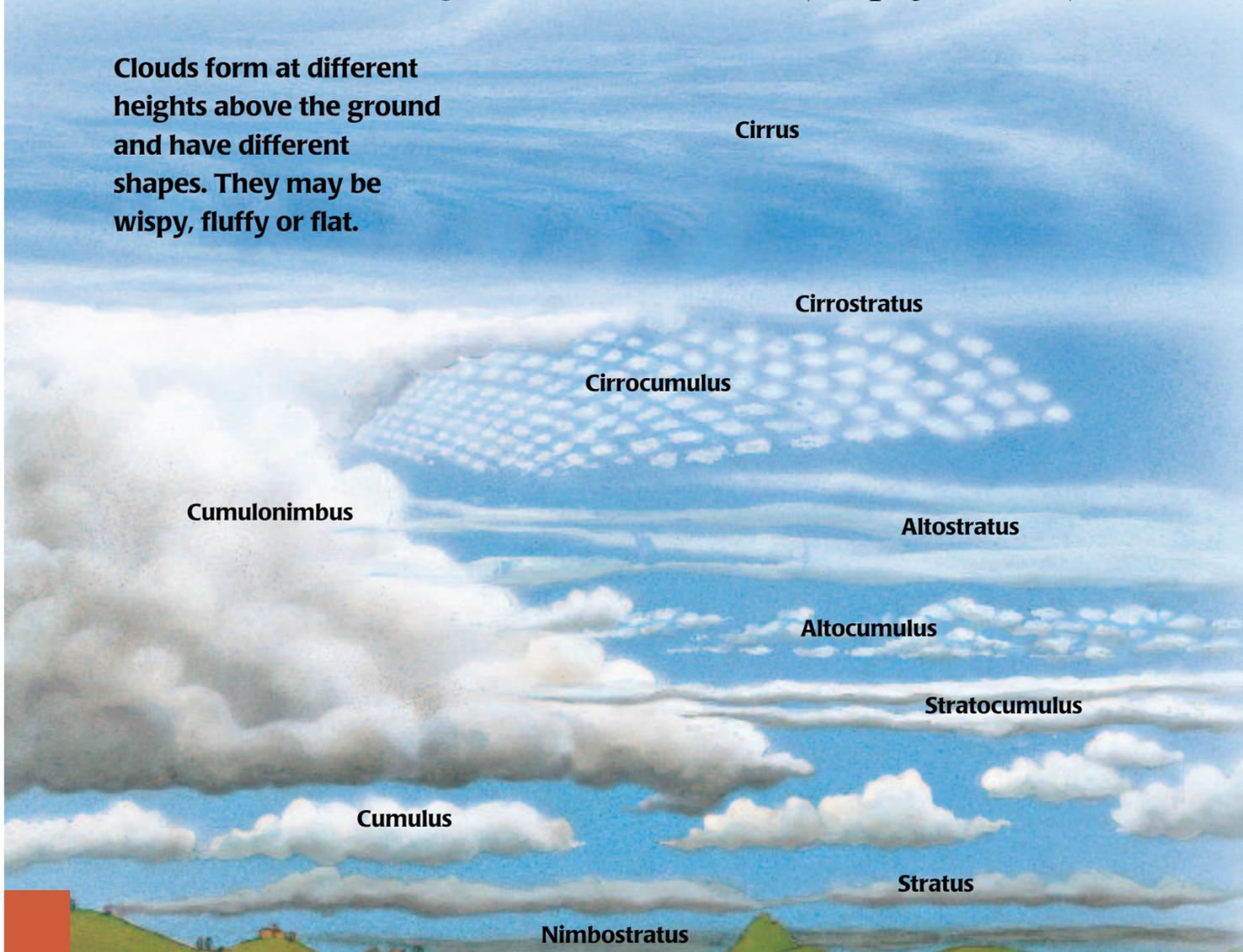
Water evaporated from the oceans may be carried as water vapour across land. As it rises above high ground, it condenses and falls to earth as snow or rain. Rivers carry the water on the land's surface back to the ocean and the cycle begins again.

# WEATHER AND CLOUDS

**W**EATHER is a word to describe the what is happening in the air: rain or snow, hot or cold, windy or still. The Sun's heat is vital to our weather. Some regions

are warmer than others. Warm air rises, so cooler air flows in to replace it, producing winds. When air moves, it carries water vapour from one area to another (*see page 22-23*).

**Clouds form at different heights above the ground and have different shapes. They may be wispy, fluffy or flat.**



## CLOUDS IN CLOSE-UP

Clouds consist of millions of tiny water droplets or ice particles. When water vapour in the air condenses, water droplets form around dust particles (*see page 22*). If the temperature falls below freezing, the droplets turn to ice. They float in the air until they become too heavy. They then fall as rain or snow.



## A FOGGY DAY

Fog or mist (a thin fog) is cloud that hugs the ground. It is often foggy when moist air cools at night, causing water droplets to form. Fog also forms when moist air is forced to rise over a hill.



**At night, the ground cools quickly. Water vapour near the ground condenses, forming dew. This soaks everything – including spiders' webs.**



**If the temperature falls below freezing, the condensed water vapour turns into a layer of sparkling ice crystals, which we call frost.**

## STORMS

**S**TORMY weather means high winds and heavy rain or snow. In some parts of the world, the extremely fast-moving winds of hurricanes and tornadoes may be powerful enough to cause severe damage and even loss of life. Heavy rainfall or blizzards may also result in floods, mudslides or avalanches in mountainous areas.

### LIGHTNING

Thunderclouds form when warm, moist air rises quickly. As water droplets and ice crystals bump together, they produce electricity. We see this as lightning. The heat of the flash causes the air around it to expand rapidly, making the boom of thunder.



### HURRICANES

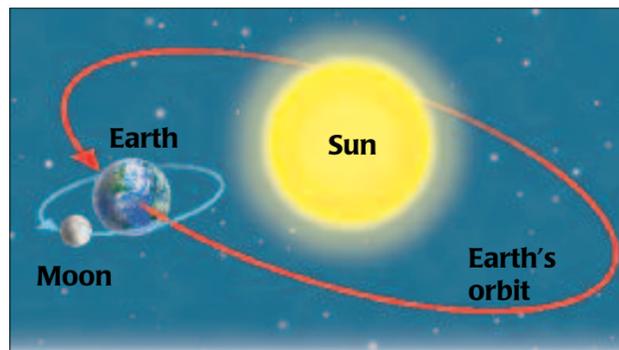
A hurricane is a storm that occurs in tropical regions. It begins when warm, moist air rises high above the oceans. The air begins to swirl around in a spiral. Clouds form and massive downpours follow. Very powerful winds rage around a calm centre, called the “eye” of the storm. When a hurricane moves across land, it can cause great damage, including ripping up trees and overturning cars.

**A tornado is a twisting column of air, swirling at up to 400 km per hour. Its base may be only 100 m across, but the winds are so powerful they destroy nearly everything in their path.**



# SEASONS AND CLIMATES

**I**N MANY parts of the world, the weather changes according to the time of year. These are the changing seasons. Different patterns of weather, including rainfall, winds and temperature, are found in different parts of the world. These patterns are called climates.

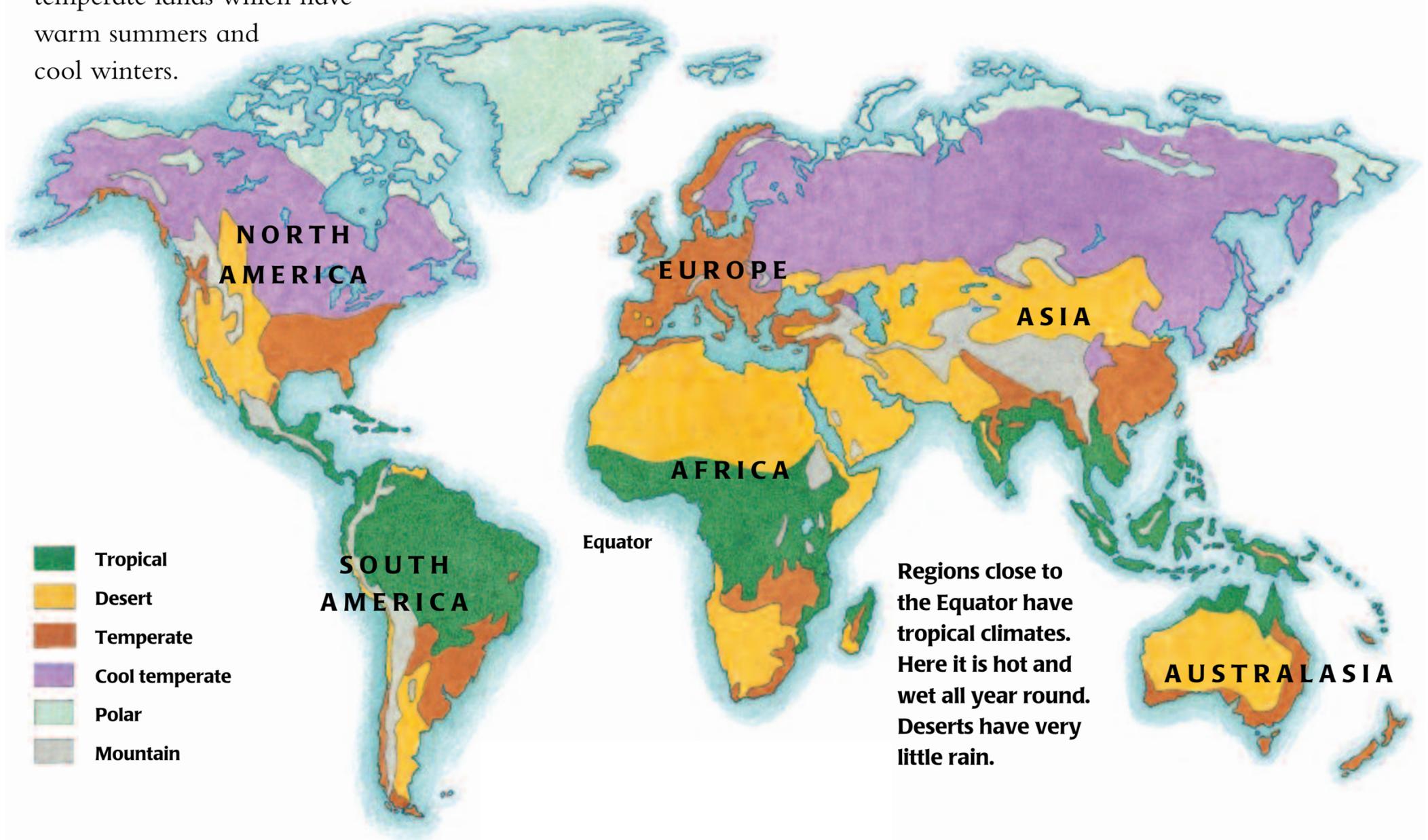


## THE EARTH IN ORBIT

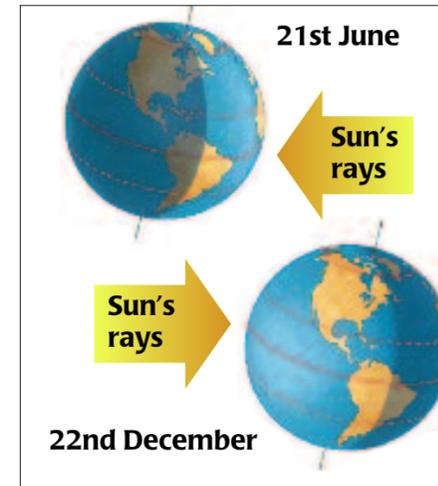
The Earth orbits the Sun in just over 365 days. The Moon orbits the Earth in about 27 days. The Earth spins once every 24 hours.

## EARTH'S CLIMATES

Hot climates are found near the Equator where the Sun is closest. Polar regions, where the Sun is furthest away, are the coldest. In between are temperate lands which have warm summers and cool winters.



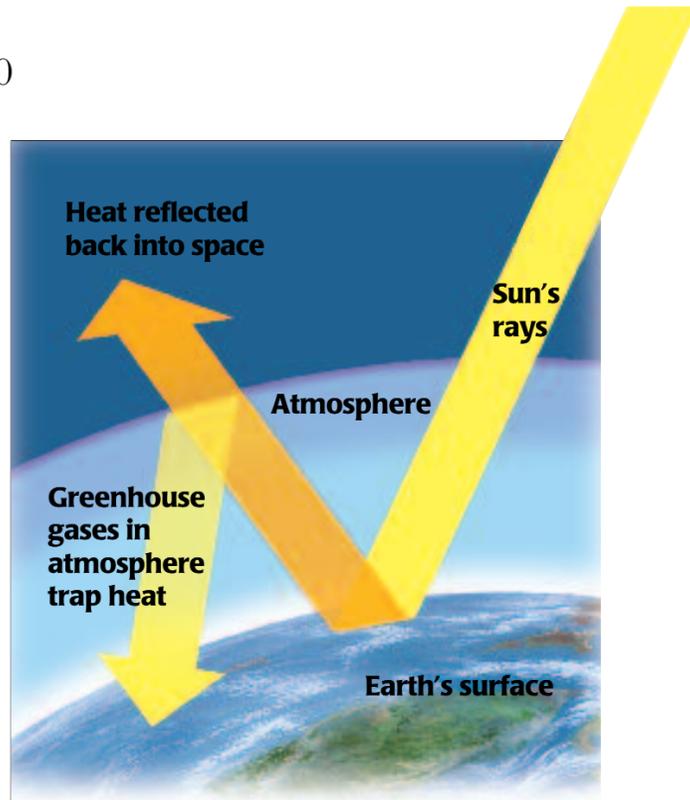
## THE SEASONS



As the Earth spins round, it is not upright but tilted. When the northern half (the northern hemisphere) leans towards the Sun, the Sun is nearer. It is summer. Later in the year, the southern hemisphere is nearer the Sun and has its summer. The northern hemisphere is further away and has winter.

# GLOBAL WARMING

**T**HE EARTH is getting warmer. Average temperatures worldwide have risen during the last century and there is no sign of this rise slowing. There is now a high risk that the ice caps will start to melt, raising sea levels everywhere and changing world climates.

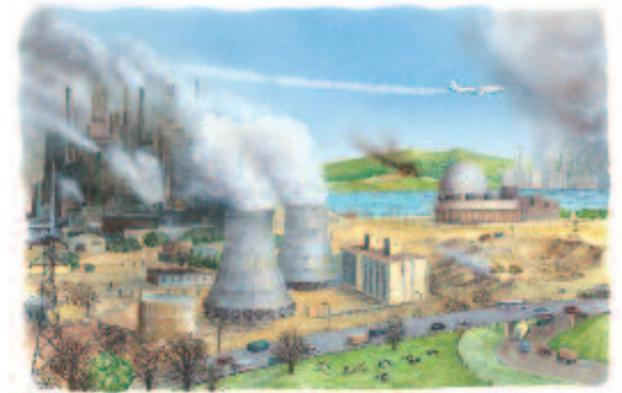


## GREENHOUSE EFFECT

The atmosphere contains gases that stop all the Sun's heat escaping. These gases act like the glass in a greenhouse. They help keep the Earth's surface warm.

## WHY IS IT HAPPENING?

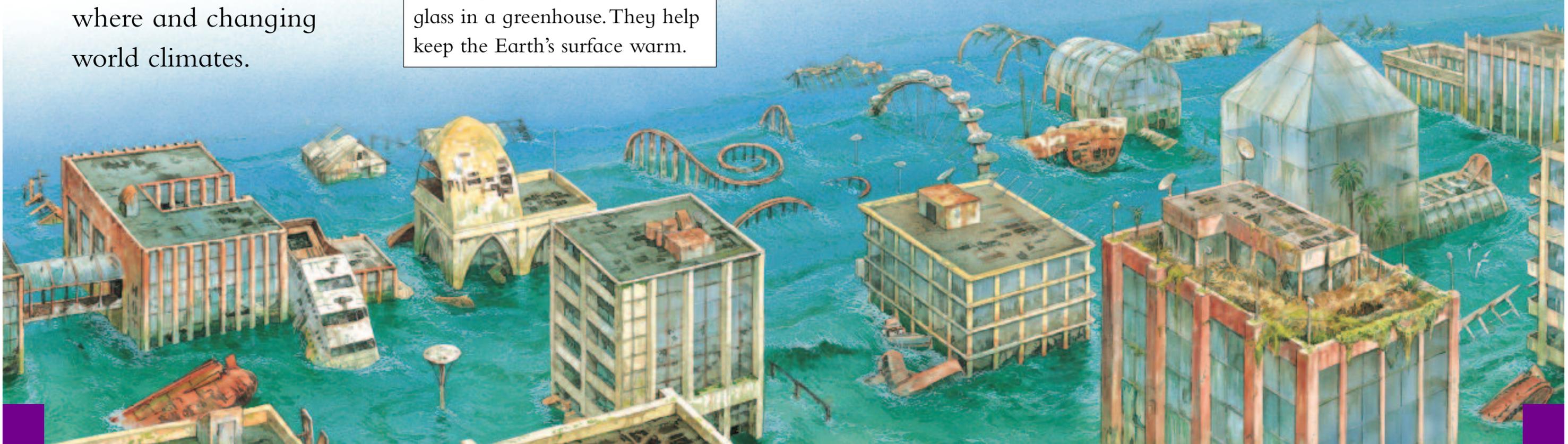
Global warming is probably caused by the greenhouse effect (see panel). Human activities have resulted in a large increase of greenhouse gases, such as carbon dioxide, in the atmosphere. Vehicles and power stations give off exhaust gases from burning oil or coal ("fossil fuels"). These add billions of tonnes of carbon dioxide to the atmosphere. Plants will usually



absorb (take in) carbon dioxide as part of their natural life cycle. But the destruction of forests around the world means there are fewer plants to absorb the gas.

**If melted ice cause sea levels to rise, it may result in many coastal cities being flooded by sea water. To avoid this**

**calastrophe, people must reduce the amount of greenhouse gases in the air by burning fewer fossil fuels.**



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