» 1 Living with earthquakes and volcanoes

Earthquakes and volcanic eruptions can have disastrous effects, especially if they happen in places where many people live. Understanding the causes and effects of earthquakes and volcanoes can help to reduce their effects on people and environments.

Learning objectives

What are you going to learn about in this chapter?

- Where earthquakes and volcanoes happen
- Why earthquakes and volcanic eruptions happen
- The effects of earthquakes and volcanoes in different parts of the world
- How the effects of earthquakes and volcanoes can be reduced
- How a tsunami starts
- What it is like to live through a tsunami
- Why aid is needed after a natural disaster
- Why people live in active areas

A Earthquake in Kobe, Japan

What is the earth like?

- Understanding that the earth is not a solid mass
- Finding out that inside the earth it is very hot

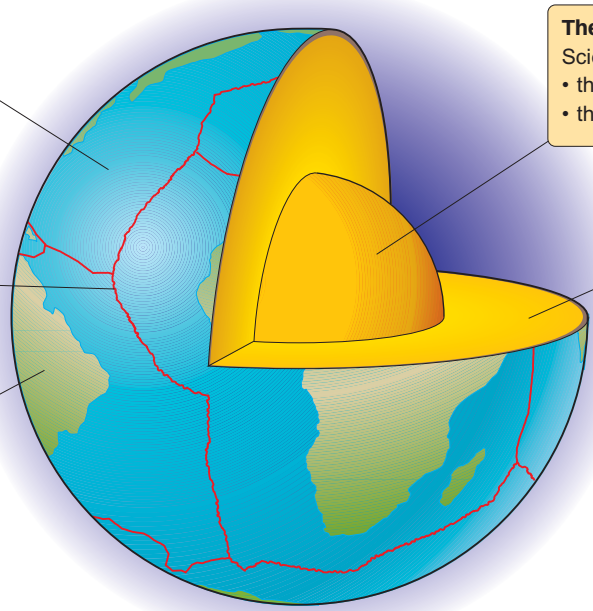
The earth is made up of three main layers: the crust, the mantle and the core (**A**). The crust is a thin surface which forms the land on which we live. It floats on the semi-liquid (**molten**) mantle. The core is the centre of the earth and is made of iron.

A The earth's layers

Plates
Huge blocks of the earth's crust.

Plate boundary
Where plates meet.

The crust
- Where land is on the surface it is called continental crust and is usually 20–60 km thick.
- Where oceans are on the surface it is called oceanic crust and is thinner – usually between 8 and 25 km thick.
- In some places the crust is very thin and molten material bubbles up to the surface through cracks – these are called 'hot-spots'.



The core
Scientists believe that:
- the inner core is solid, because it is so dense
- the outer core is molten rock.

The mantle
The mantle is a layer of molten rock (**magma**) underneath the crust.

Geothermal Power Station Uses hot underground rocks to produce hot water and electricity.

Hot Springs, Geysers Water heated up underground rises to the surface under enormous pressure.

B Evidence to show that temperatures inside the earth are higher

HOW HOT IS IT INSIDE THE EARTH?

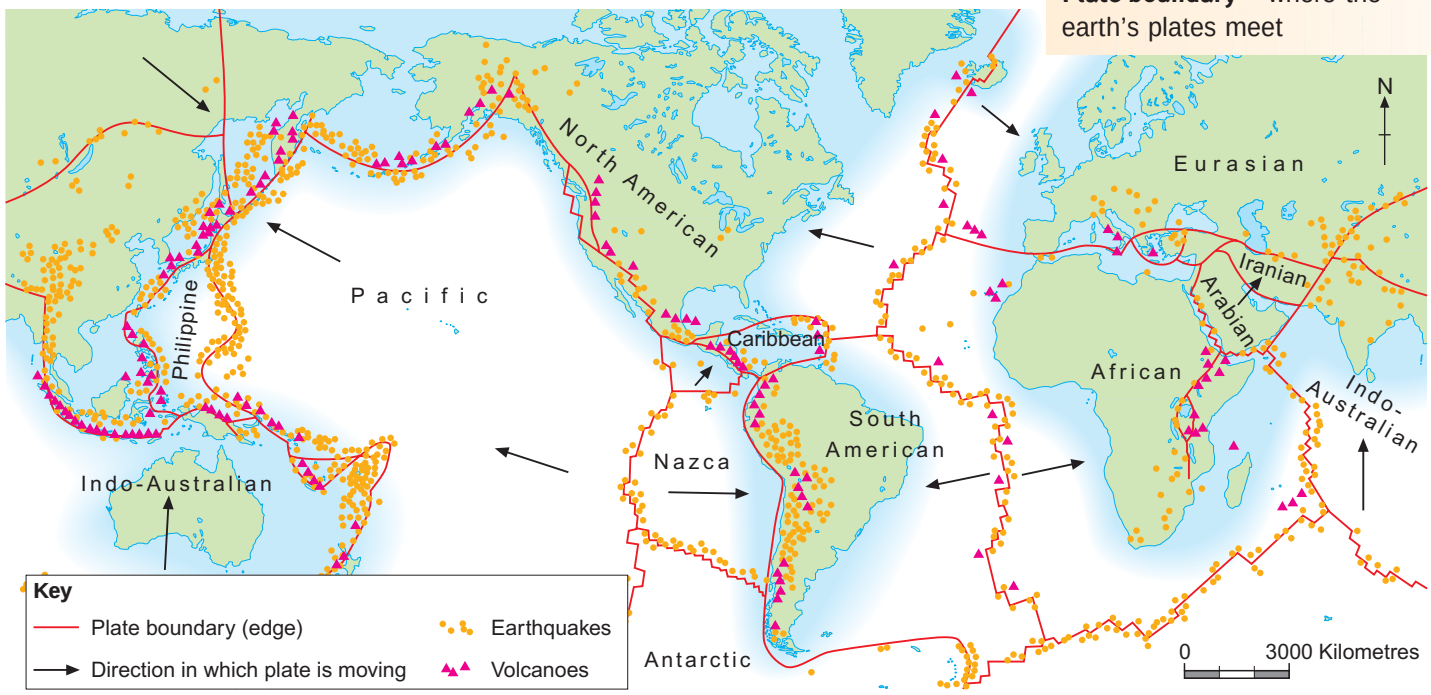
No one really knows the answer to this question, but we do know that inside the earth is hotter than the outside. One way we can tell this is when volcanoes erupt or red hot **lava** comes to the earth's surface. The photographs in source **B** show other evidence which tells us that temperatures are higher inside the earth.

THE EARTH'S CRUST

The earth's crust is not one solid mass. It is made up of large pieces called plates (map **C**). **Continental Plates** have land on the surface and **Oceanic Plates** have an ocean on the surface. The plates are slowly moved around by currents inside the earth. Notice how in some places the plates are moving towards each other and in other places they are moving apart. Plate boundaries are the places where plates meet – this is where earthquakes and volcanoes often occur.

Key words

Continental Plate – plate with land on the surface
Lava – molten rock on the earth's surface
Magma – molten rock inside the earth
Molten – melted
Oceanic Plate – plate with an ocean on the surface
Plate boundary – where the earth's plates meet



C The earths's major plates

Activities

1 Copy out the following paragraph. Use the words in the box below to fill in the gaps. Start by putting the heading: 'What is the earth like?'

The earth is made up of _____layers, the crust, the _____ and the core. The _____ is the part we live on and is between 8 and 60 km thick. The mantle is made up of _____rocks called _____. The core is in the _____ of the earth and is made of _____.

iron	three	molten	mantle
magma	centre	crust	

2 How can you tell that it is hot inside the earth? Write a brief paragraph, starting with: 'There are many ways you can tell that it is hot inside the earth …' and go on to mention *two* ways you can tell it is hot inside the earth.

3 Look at source **C**.

a) Which plate does Britain lie on?

b) Why does Britain not have major earthquakes and volcanoes?

c) Why is the edge of the Pacific Ocean often called 'the Pacific ring of fire'?

4 Below are some sentences that describe the location of volcanoes. Write out the *two* that are correct.

- There are volcanoes along the west coast of South America.
- Britain has lots of active volcanoes.
- The east coast of North America has lots of volcanoes.
- East Africa has a line of volcanoes.

Why do earthquakes and volcanoes occur in certain places?

- Understanding that the earth's crust is made up of a number of separate pieces called plates
- Finding out why earthquakes and volcanoes happen near the edges of the earth's plates

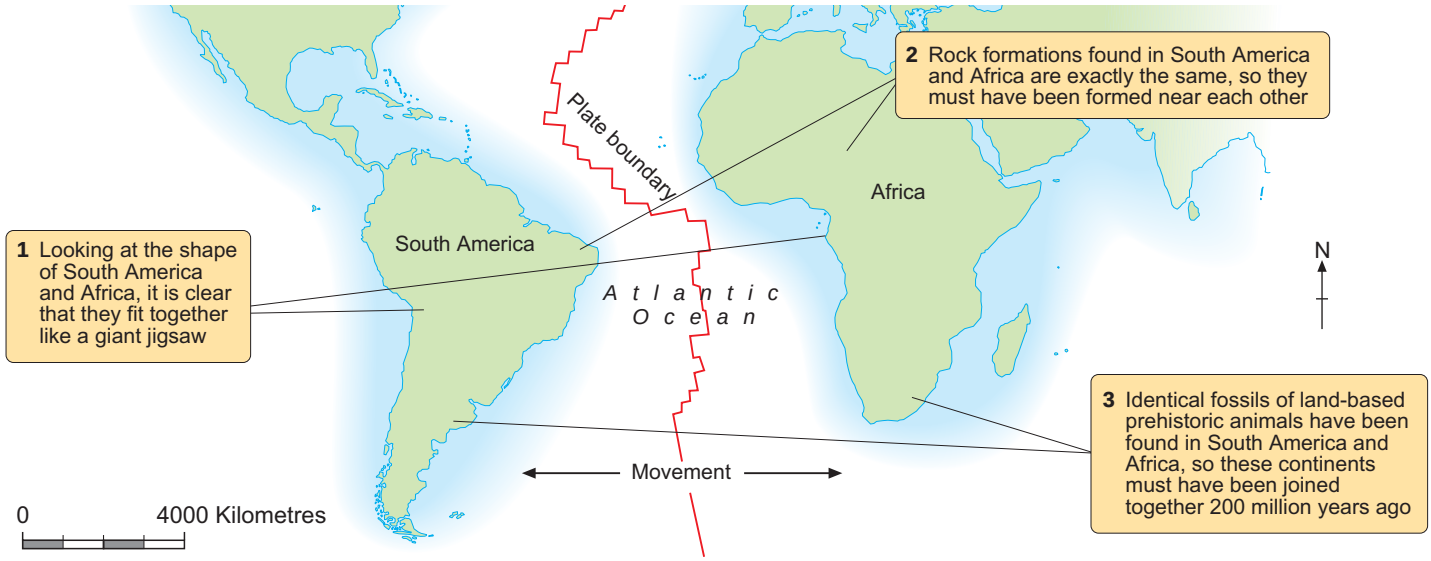
The earth's crust is made up of a number of huge pieces called plates. These plates are moved by the currents in the hot rocks below the surface. The edges of plates are called margins or boundaries.

HOW FAST DO THE PLATES MOVE?

The plates move between 1 cm and 12 cm a year, which is about the speed of growing fingernails! This does not sound very fast but don't forget that the earth is millions of years old, so a small movement can make a big difference given enough time.

About 160 million years ago South America and Africa were next to each other; today they are separated by the Atlantic Ocean (**A**).

HOW CAN WE TELL THAT THE EARTH'S PLATES MOVE?

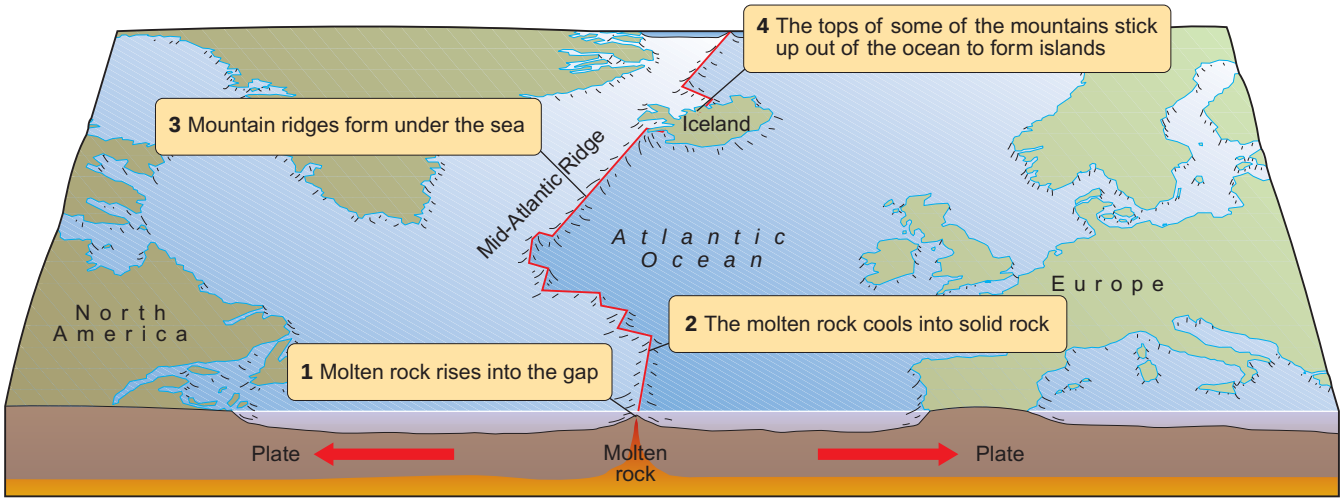


A Plate movement

WHAT HAPPENS WHERE PLATES MEET?

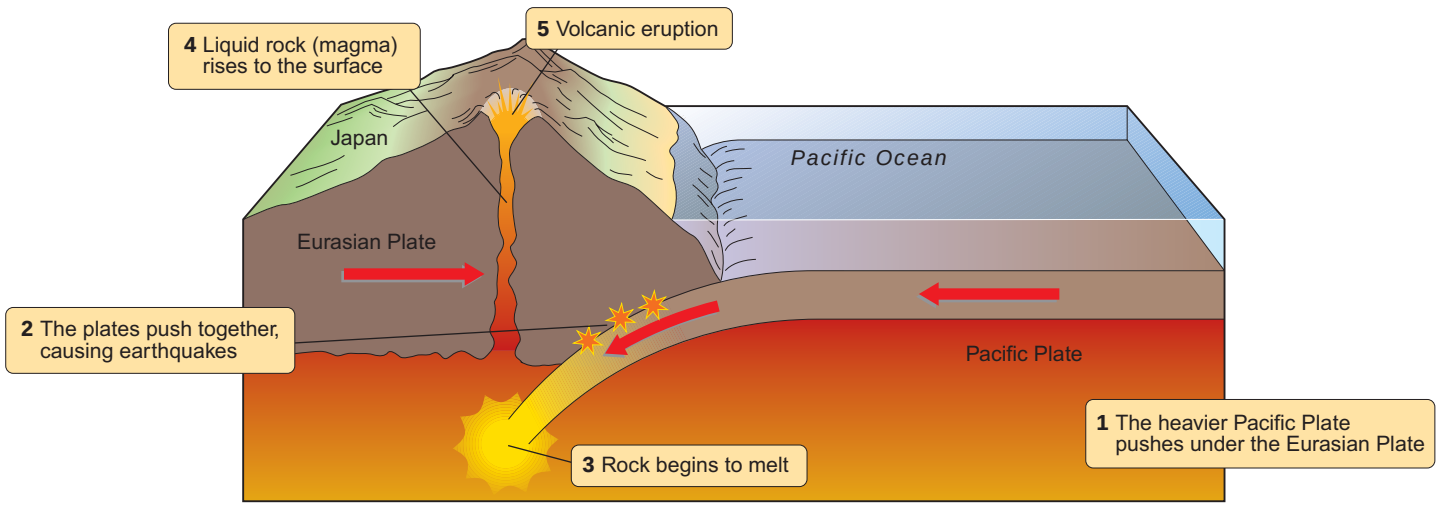
Plates can move apart, push together or slide past each other. This means that the area where plates meet is very unstable.

WHAT HAPPENS WHEN TWO PLATES MOVE APART?



B Plates moving apart

WHAT HAPPENS WHEN AN OCEANIC PLATE AND A CONTINENTAL PLATE PUSH TOGETHER?



C Oceanic and continental plates pushing together

Activities

1 Copy and complete the following sentences using the words in the box below.

a) The earth's crust is made up of a number of _____.

b) The plates are moved about by the _____ below.

currents	plates

2 Explain how you can tell that South America and Africa haved moved apart.

3 Write out these statements in the correct order to show what happens when plates move apart.

- Undersea ridges and mountains are formed
- Molten rock rises to the surface and cools
- Two plates move apart

4 Draw a diagram to show what happens when oceanic and continental plates push together. Mark on:

– Volcano – Melting rock

– Rising magma – Start of an earthquake

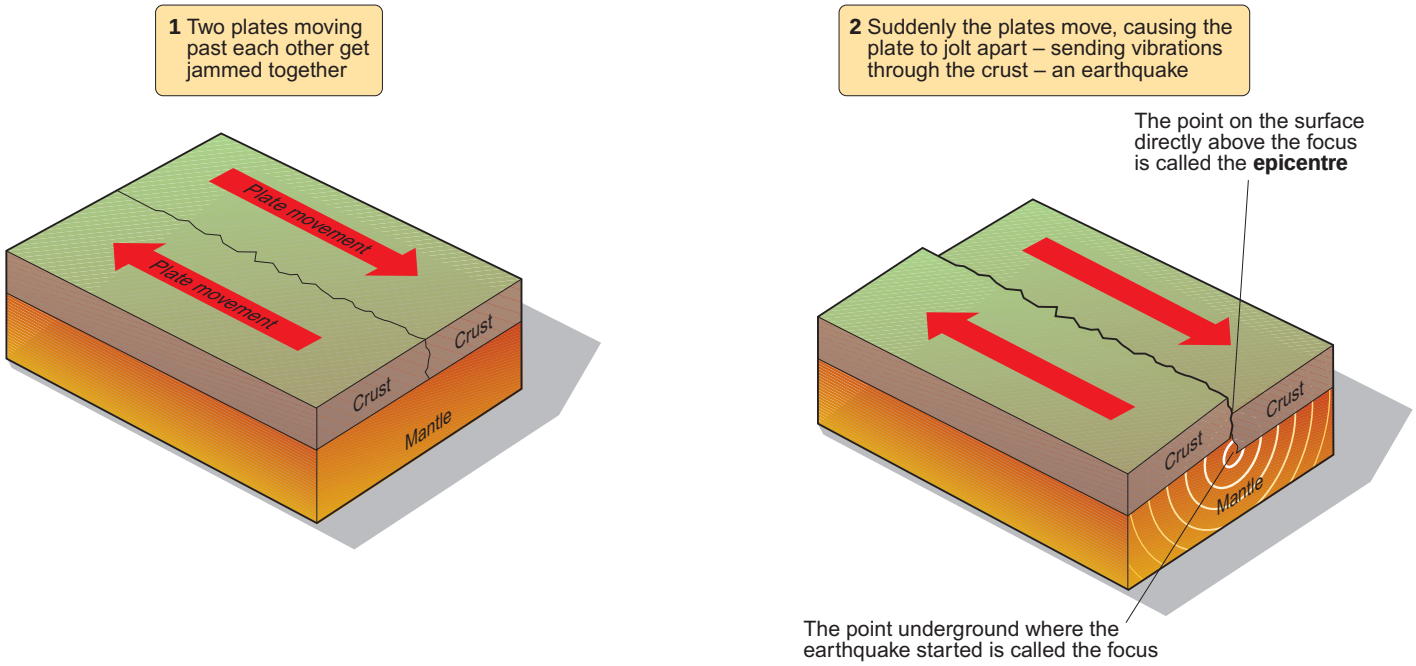
What happens in an earthquake?

- Finding out why the earth shakes
- Learning about how earthquakes are measured

Key words

Epicentre – the point on the earth's surface above where an earthquake starts

Most earthquakes happen when two of the earth's plates stick as they push past each other (**A**).



A How an earthquake can happen

FACT FILE

The word seismic is Greek for 'shake'. As earthquakes cause the ground to shake, anything to do with earthquakes is called seismic!

WHAT ABOUT THE STRENGTH OF AN EARTHQUAKE?

The strength of an earthquake is measured by the Richter scale. The higher the number on the scale the greater the damage.

The Richer scale is calculated using a mathematical equation so is very accurate

The Richter scale

Measures the amount of energy released.

1 Only noticed by instruments
2 Barely felt
3 Slight vibrations
4 Windows rattle, some movement, minor damage
5 Some damage to buildings
6 Walls crack, some buildings collapse
7 Ground cracks – many buildings collapse
8 Large areas destroyed
9 Widespread destruction

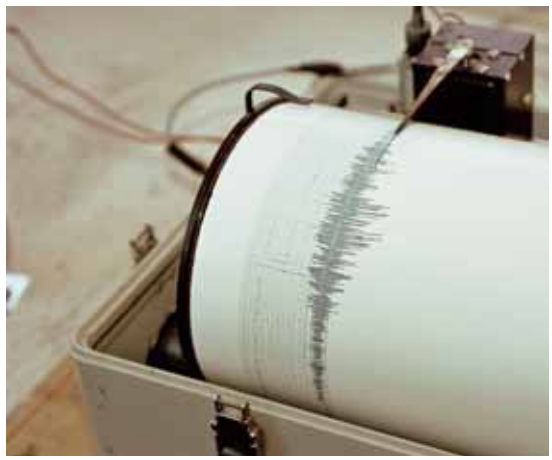
Each number is ten times more powerful than the last

8.9 Strongest recorded earthquake

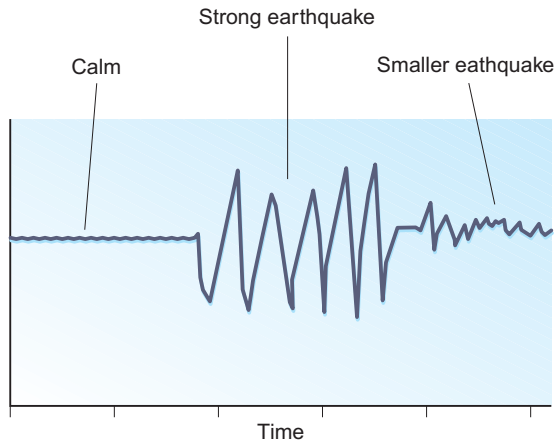
HOW ARE EARTHQUAKES MEASURED?

An instrument called a seismometer is used to record the shaking of the earth (photo **B**).

The information collected is shown on a seismograph (**C**). Comparing seismographs from different places can help to tell where an earthquake started.

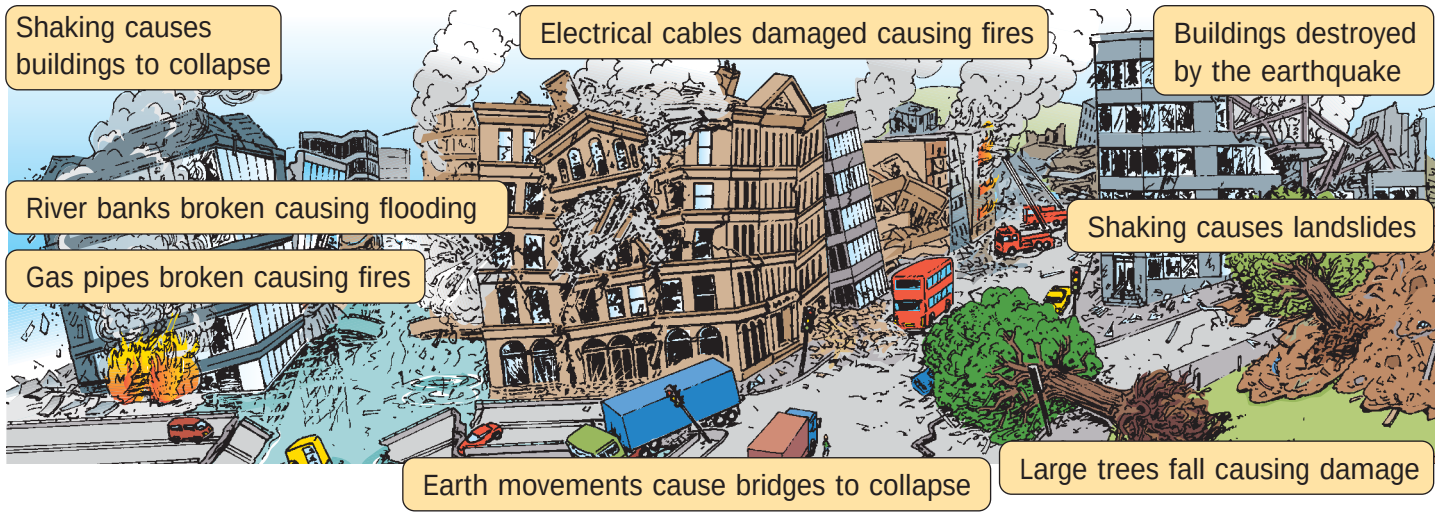


B A seismometer



C A seismograph

HOW DO EARTHQUAKES CAUSE DAMAGE?



Activities

1 What does the word 'seismic' mean?

2 Draw a diagram like the one on the right.

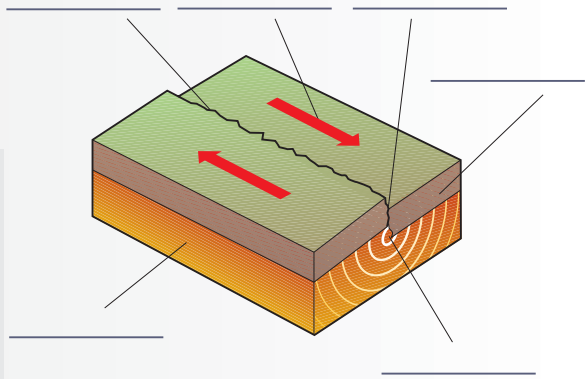
Add the words from the box below to explain how an earthquake happens.

Crust	Mantle	Vibrations
Plate movement	Focus	Epicentre

3 Copy out and complete the table, which describes the effects of earthquakes of different strengths.

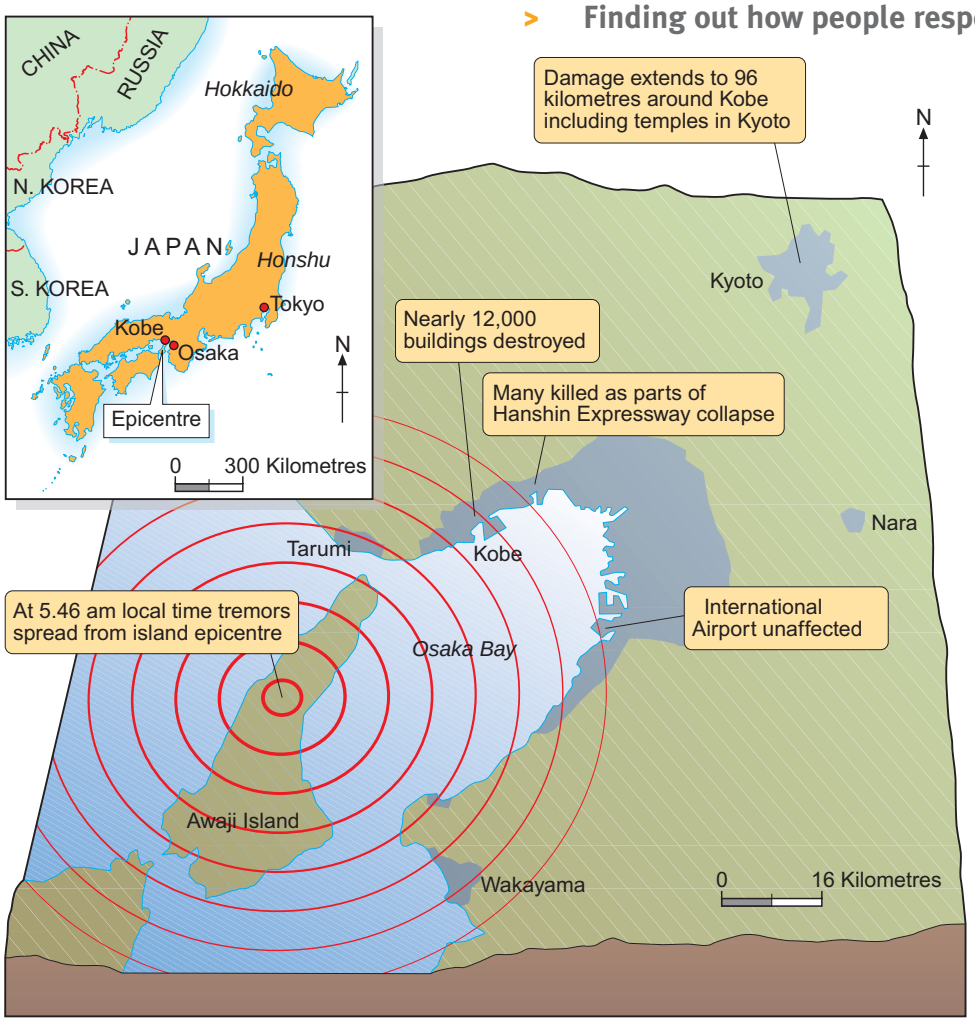
Type of damage	Richter scale
Barely felt	2
	4
	6
Widespread destruction	9

4 Describe *three* ways in which earthquakes can cause damage.



Case study: the Kobe earthquake – Japan

- Understanding the effects of an earthquake
- Finding out how people respond to earthquakes



A How the earthquake struck

Kobe is the sixth largest city in Japan and one of the world's largest ports.

At 5.46 am on 17 January 1995 the city was rocked by a massive earthquake (**A**) recorded at 7.2 on the Richter scale.

In a matter of minutes one of the most modern cities in the world had become a disaster area (**B**, **C**).

FACT FILE

Kobe was Japan's worst earthquake for 72 years

6,310 people were killed

45,000 people were hurt

75,000 buildings were damaged

Rebuilding the city cost over £80 billion

B Damaged highway following the Kobe earthquake

C Damaged buildings following the Kobe earthquake

WHAT WAS IT LIKE TO LIVE THROUGH THE EARTHQUAKE?

These comments were made by people in the area at the time of the earthquake.

'There was a rumbling sound that got louder and louder. Everything started to shake – a lot of buildings began to collapse. Most people did not have time to get out.'

Local resident

'I was driving to work and the car was suddenly thrown across the road. All the cars stopped. It was only later I was told that the road ahead had collapsed, killing a number of people.'

Local factory worker

'I was staying in a hotel and was woken up by a flash that lit up the sky. I was later told it was an electrical explosion. Everything began to move. It seemed to last for ages, but was probably only about 20 seconds.'

Visiting businessman

WHAT WAS IT LIKE FOR THE EMERGENCY SERVICES?

Local fireman

'The biggest problem was that fires were breaking out everywhere. Gas mains and electrical cables were damaged, causing thousands of fires. We could not cope with them all.'

Ambulance driver

'The biggest problem was getting to people who needed help. Lots of the roads and bridges were damaged. Others were blocked by buildings that had collapsed.'

REBUILDING THE AREA

Within two years of the earthquake, a lot of the damaged areas had been rebuilt (**D**).

To make sure that the effects of any future earthquakes are reduced, the following measures have been put in place:

- Making sure that new roads are wider
- Leaving more space between buildings
- Using building materials that do not catch fire so easily
- Making buildings stronger and more flexible
- Not building on unstable ground

D Kobe city rebuilt two years after the earthquake

Activities

1. Write a heading 'The Kobe Earthquake – Japan'. Underneath the heading write down:
   - when it happened
   - how powerful it was
   - the effects on people
   - the effects on buildings.
2. Why might the effects have been worse if the earthquake had happened between 8.00 and 9.00 am?
3. Complete a table like the one started here, which describes one point made by each of the three people talking about what it was like to live through the earthquake.

Person	Point
Local resident	Buildings began to shake and many collapsed

4. a) Draw an outline sketch of photo **B** showing how some roads were damaged.
   b) Put labels on your sketch to describe the main points. (See page 154 of *SKILLS in geography*.)
5. Explain how any *one* of the rebuilding ideas may make the area safer if there is another earthquake in the future.

What happened in the 2003 earthquake in Iran?

A Bam, Iran

- Learning about the effects of an earthquake in a developing country
- Understanding the effects of an earthquake in a developing country

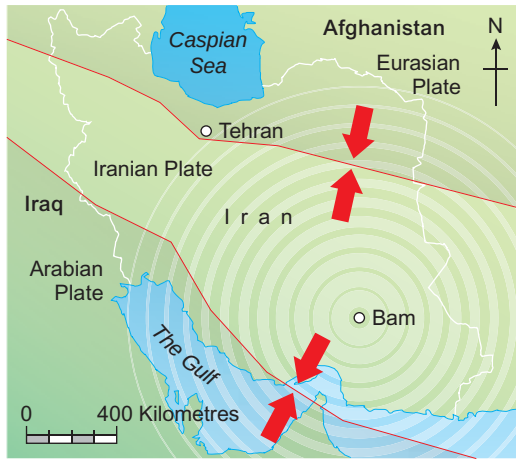
On Friday 26 December 2003 at 5.27 pm a major earthquake hit the Iranian city of Bam, a city of 80,000 people (**A**). The city is famous for its 2,000-year-old red brick citadel and fortress, which attracts thousands of tourists each year.

WHAT CAUSED THE EARTHQUAKE?

The Iranian plate and the Arabian plate pushed together. This caused a shockwave which was the start of the earthquake (**B**).

The following news reports describe what it was like in Bam after the earthquake.

C Bam Citadel before the earthquake



B Plate movement causing the earthquake

D Bam Citadel after the earthquake

QUAKE ROCKS ANCIENT CITY OF BAM

Over 20,000 people were killed yesterday when an earthquake hit the ancient Iranian city of Bam. With thousands of homes destroyed, there are fears that many more will die from being left homeless in the winter cold.

Bam is an ancient city of over 80,000 people, with many mud brick buildings over 2,000 years old. It only has two hospitals and both were badly damaged by the earthquake.

EARTHQUAKE KILLS THOUSANDS

Just before dawn this morning an earthquake devastated the city of Bam in Iran. Mud brick homes in the city and surrounding villages were reduced to rubble and up to 40,000 people are feared dead. Rescue volunteers, doctors and paramedics are being flown to the country to help survivors, many of whom have lost everything.

CITY OF BAM DESTROYED IN DEADLY EARTHQUAKE

Thousands of homes were destroyed when an earthquake hit the ancient Iranian city of Bam yesterday. Over 20,000 people were killed and many more may die of cold or threat of disease. The two hospitals in the city have been damaged so people cannot get the help they desperately need.

D Emergency shelter after the earthquake

BAM – ONE YEAR ON

It often takes poor countries a long time to rebuild after an earthquake. A television reporter visited Bam a year after the earthquake and made the following notes:

- There are still lots of homeless people.
- Lots of people are still living in tents on the edge of the city.
- Piles of rubble are everywhere.
- Lots of new houses have been built.
- Most of the roads have been cleared.

Activities

S

1 Write the title 'The Bam earthquake – Iran 2003'.

a) Copy out and complete the following sentences.

The number of people living in Bam is _____.

The ancient Citadel is _____ years old and made from _____ _____.

b) Copy out the following passage, which describes what happened in the Bam earthquake. Use the words in the box below to complete the passage.

The earthquake happened because the Iranian and Arabian _____ moved together, causing the ground to _____. It happened _____ in the morning and many people were asleep in their red _____ houses. Most houses were poorly _____ and _____ during the earthquake. Both _____ were damaged and people had to be flown 100 miles for medical help.

collapsed	hospitals	plates	early	brick	shake	built	

2 Copy out and complete the table below by adding *four* other types of structures that may have been damaged by the earthquake.

Earthquake damage	
Houses	Roads

3 a) Why does it take a long time for poor countries to get back to normal after an earthquake?

b) List *two* things that have been done and *two* things that are still needed a year after the earthquake.

What happens when a volcano erupts?

- Learning about different types of erupted material
- Understanding the effects of an erupting volcano

WHAT IS A VOLCANO?

A volcano is an opening or vent in the earth's crust where different materials are able to reach the earth's surface (**A**–**D**).

WHAT SORTS OF MATERIAL CAN REACH THE EARTH'S SURFACE?

Lots of different types of material can be forced up from inside the earth's crust during a volcanic eruption. Not all volcanic eruptions are explosive. In places like Hawaii lava flows in channels and can be studied at quite close range.

A Molten lava (liquid rock) can be:
– thick and sticky and move quite slowly
– thin and runny and flow very quickly.

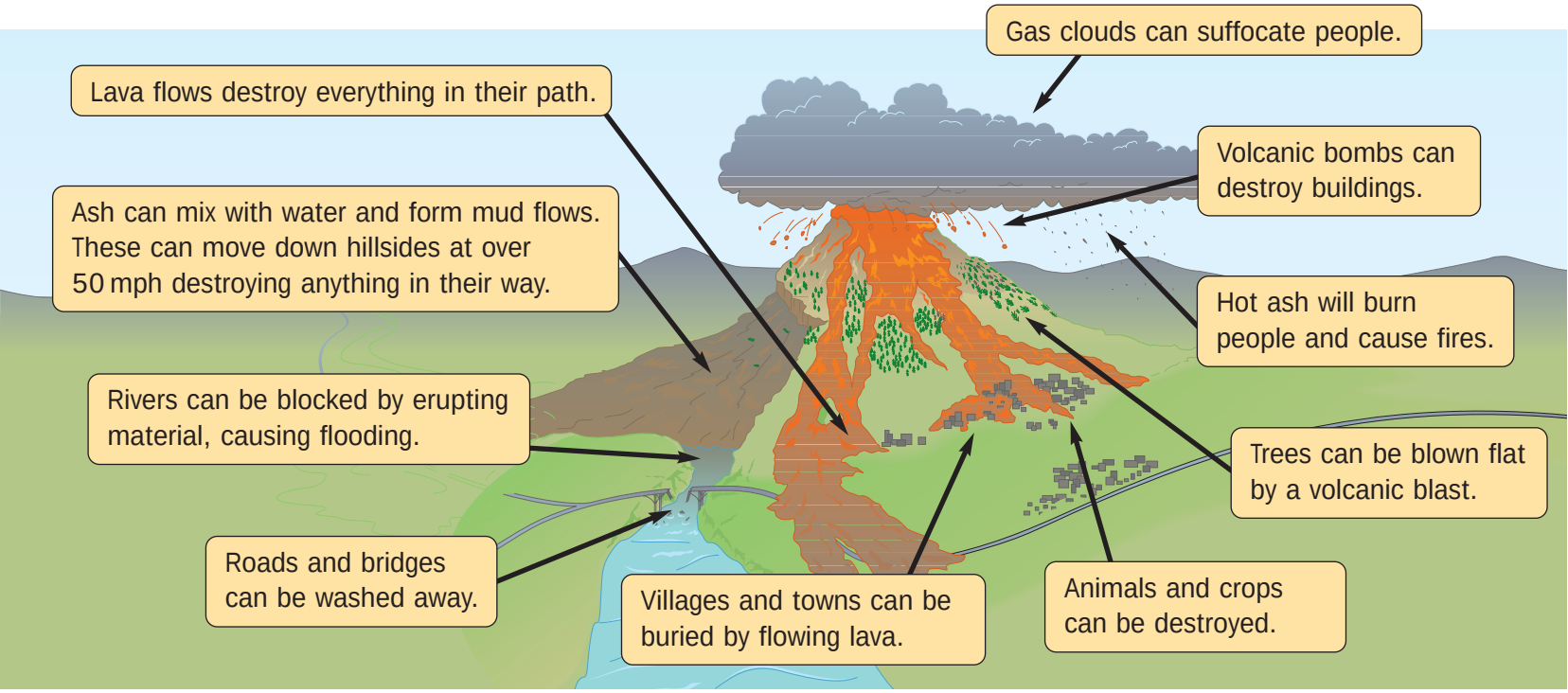
B Steam and volcanic dust often come out of small eruptions.

Types of material erupted from the earth

C Red hot ash is erupted from many volcanoes and is very dangerous.

D Volcanic bombs – large blocks of hot rock – can be thrown hundreds of feet in the air during an eruption.

WHAT DAMAGE CAN A VOLCANIC ERUPTION CAUSE?



ARE ALL VOLCANOES ACTIVE?

Volcanoes can be active, dormant or extinct.

Active volcanoes have erupted recently and are expected to erupt again. There are over a thousand active volcanoes, many around the edge of the Pacific Ocean.

Dormant volcanoes have not erupted for many years but could still erupt.

Extinct volcanoes are not expected to erupt again in the future.

Activities

1 Copy out and complete the following sentences (look back to page 7 to help you):

Magma is …

Lava is …

2 Copy out and complete the following table to show the different types of material that can come out of erupting volcanoes.

Material erupted from the earth	
Steam	
Ash	

3 Write a sentence about how volcanic eruptions can damage each of the following:

– People – Roads

– Buildings – Farmland

4 **Research task** Use the internet (see Hotlinks, page ii) to find two examples each of:

– active volcanoes

– dormant volcanoes

– extinct volcanoes.

5 Use the internet (see Hotlinks, page ii) to locate *five* volcanoes currently erupting.

Case study: the eruption of Mount Nyiragongo, Congo

- Understanding what it is like to live through a volcanic eruption
- Finding out the problems of living with hazards in poor countries

A Mount Nyiragongo, Congo

Source: Developed by Lyn Topinka, Cascades Volcano Observatory

On Thursday 17 January 2002 Mount Nyiragongo, a volcano in Central Africa, began to erupt (map **A**). In the lakeside city of Goma, ten miles to the south, the local people had no idea of what was going to happen over the next two days.

Mount Nyiragongo is a steep-sided mountain, so when it erupted, the lava flowed like a river towards Goma. As the lava reached Goma, it began to cool, filling the streets with thousands of tonnes of cooling rock (photo **B**).

WHAT WAS IT LIKE LIVING THROUGH THE ERUPTION?

The following newspaper article and sources **B** and **C** show what it was like to live through the eruption.

The African city of Goma was lit up by a volcanic eruption last night as lava poured from the sides of Mount Nyiragongo. It destroyed many small villages as it made its way towards Goma, on the shore of Lake Kivu. Buildings were turned to ash by the red hot lava and many people had to run for their lives.

By early this morning nearly 300,000 people had left Goma – the city looked like a ghost town. On the edge of the city the only airport had been destroyed and many buildings could be seen burning.

B Destruction in the main street of Goma

C Experiences during and after the eruption

‘The lava flowed through Goma and into Lake Kivu. Lots of people escaped by boat. Some said the lava had heated the lake up so much that it was like bath water!’

Local fireman

‘Many people are living on the streets. They have no shelter and little food.’

Aid worker

‘We had to leave our home. I tried to return a few days later but everything was destroyed.’

Local resident

‘I was working in the area. I could not believe the noise and the smell of chemicals as the lava flowed through the streets of Goma.’

Foreign worker

‘The eruption was so powerful it woke me up and shook my bed – and I was fifteen miles away!’

Tourist in nearby town

‘Many local doctors stayed in the area during the eruption and tried to help people. Thank God they are safe.’

Visiting doctor

‘I was told that the lava was flowing from Mount Nyiragongo at over thirty miles per hour!’

Student living in Goma

‘There is no safe water for people to drink. We are very worried about disease.’

Local health worker

Activities

1 Copy out the following passage which explains what happened in Goma. Use the words in the box below to fill in the gaps.

When Mount Nyiragongo _____ a flow of _____ moved towards the city of _____. It moved quickly because of the _____ slopes. The lava destroyed many farming _____ on its way to Goma, forcing people to leave their homes. On the edge of the city the _____ was destroyed, and many buildings could be seen _____. The following day, the main streets of Goma were full of thousands of tonnes of cooling _____.

steep	airport	burning	lava
erupted	villages	rock	Goma

2 a) Choose a title for the photograph on the opposite page (**B**).

b) Describe *three* points from the photograph.

3 Copy out and complete the table below using *three* more of the experiences in source **C**.

Experiences of the eruption	
Person	**Experience**
Local resident	Had to leave home

4 Why will it be difficult to get food and clean water to the people of Goma?

How can earthquakes and volcanoes be made less of a hazard?

- **Understanding that prediction, planning and preparation can reduce risks**
- **Learning about some of the methods used to reduce the risks of earthquakes and volcanoes**

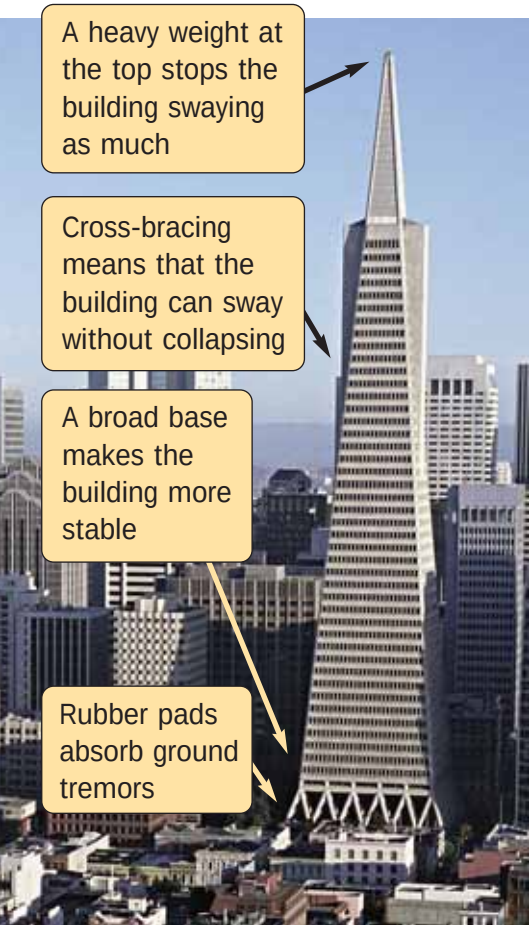
Emergency planning officer

'It's not easy but there are things we can look out for and do.'

CAN EARTHQUAKES BE PREDICTED?

- We know that most earthquakes happen near the edges of plates so we can use instruments (**A**) to tell if anything is happening in these areas.
- When there is movement underground:
  - gas is sometimes released
  - water levels change.
- Small movements can be picked up on a seismometer – this might tell us that an earthquake is on the way.

A A laser detector



B TransAmerica Pyramid, San Francisco

'The biggest danger in an earthquake is caused by buildings collapsing or catching fire. It is possible to construct buildings that are earthquake proof – The TransAmerica Pyramid in San Francisco is a good example of this.'

PLANNING FOR EARTHQUAKES

The following measures can reduce the risks from earthquakes:

- Make sure bridges and roads are strong enough to withstand earthquakes.
- Use building materials that don't burn as easily.
- Leave bigger spaces between buildings for emergency vehicles.

WHY IS PREPARATION IMPORTANT IN AN EARTHQUAKE ZONE?

'Preparation is not just making sure that the ambulance, hospital, fire and police service know what to do – it is also about preparing individual people. This could save your life.'

BE PREPARED!

- Make sure you know where your local hospital is.
- Make sure everyone in your family knows what to do if an earthquake strikes.
- Make sure your furniture is fixed to walls and cannot topple over.
- Choose a safe place to shelter in your home.
- Choose a safe place to shelter in your home.
- Have spare batteries for your mobile phone and a torch.
- Prepare an earthquake emergency kit – include first-aid materials and other things you might need to survive for a couple of days.

C Earthquake preparation leaflet

WHAT ABOUT VOLCANOES?

Before volcanoes erupt there are often warning signs including:

- small earth tremors
- the side of a volcano begins to bulge or cracks appear
- small eruptions giving off heat, ash or gas.

If you know an eruption is going to happen, emergency plans can be put in place. These might include:

- moving people away from danger
- setting up emergency shelters with food, water and warm clothes
- making sure emergency transportation is available.

Activities

S

1 Copy out and complete the following sentences by adding the correct word from the box below:

_____ is about working out when something is going to happen.

_____ is about making sure buildings are well constructed.

_____ is about making sure people know what to do if an earthquake strikes.

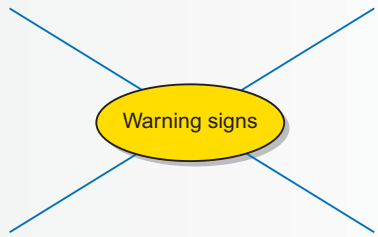
PREPARATION	PREDICTION	PLANNING

2 a) Draw a sketch of the TransAmerica Pyramid (**B**).

b) On your sketch write short notes explaining what has been done to make the building safer. (See page 154 of *SKILLS in* geography.)

3 What things other than first-aid materials might you put in an emergency earthquake kit?

4 Copy out and complete the spider diagram to show what might happen before an earthquake strikes.



5 Make up a poster to show how people should prepare for an earthquake. Be sure it has:

– a clear heading – a number of points

– some drawings and colour to make it attractive.

What is a tsunami?

- Understanding what causes a tsunami
- Finding out what can be done to reduce the effects of a tsunami

FACT FILE

The highest recorded wave created by a tsunami hit Japan in 1921 and was just under 90 metres high!

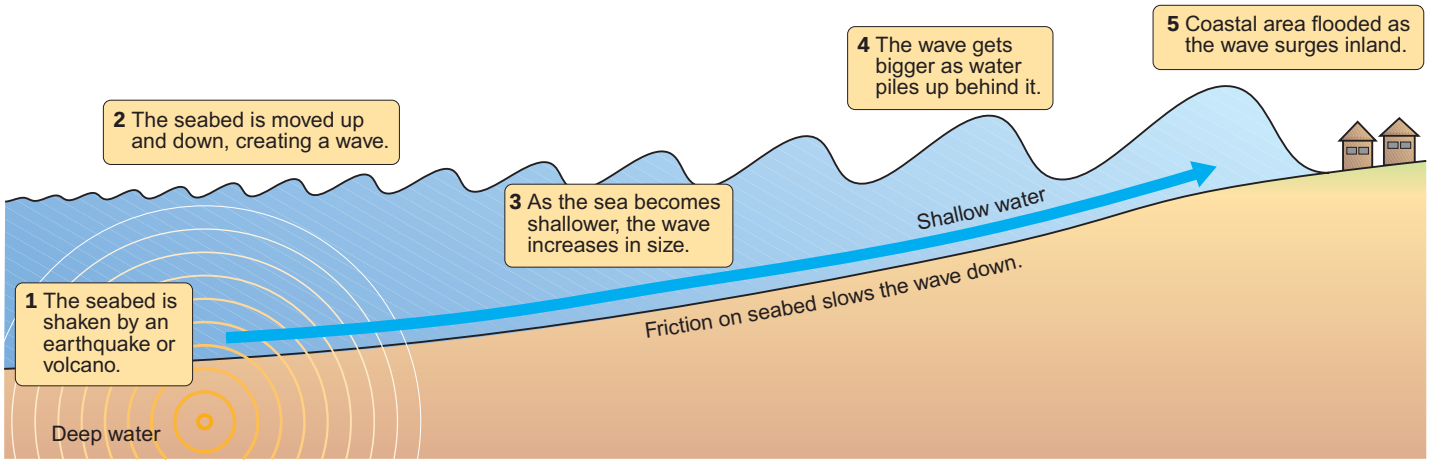
Over 80 per cent of tsunamis occur in the Pacific Ocean.

In Japanese the word 'tsu' means wave and 'nami' means harbour, so the word 'tsunami' really means 'harbour wave'. It was called this because of giant waves hitting the Japanese coast.

WHAT CAUSES A TSUNAMI?

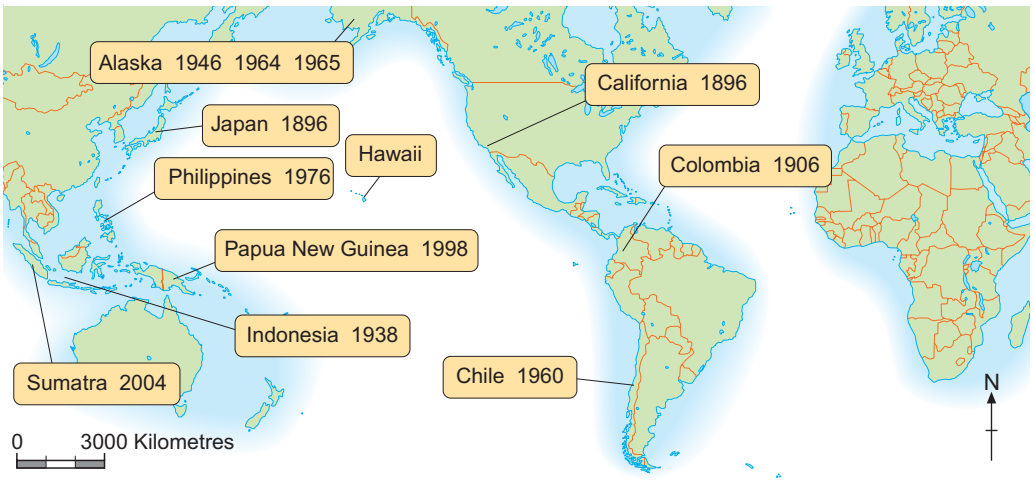
Earthquakes or volcanoes create tsunamis. Sudden movements on the seabed push water upwards and start a wave. In deep water the wave is quite small, but moves very fast – often up to 500 mph. As the wave gets near to land, it slows down but gets much bigger. It swallows everything in its way and can totally destroy coastal areas (source **A**).

HOW DOES A TSUNAMI DEVELOP?



A Development of a tsunami

HISTORIC TSUNAMIS



B Location of historic tsunamis

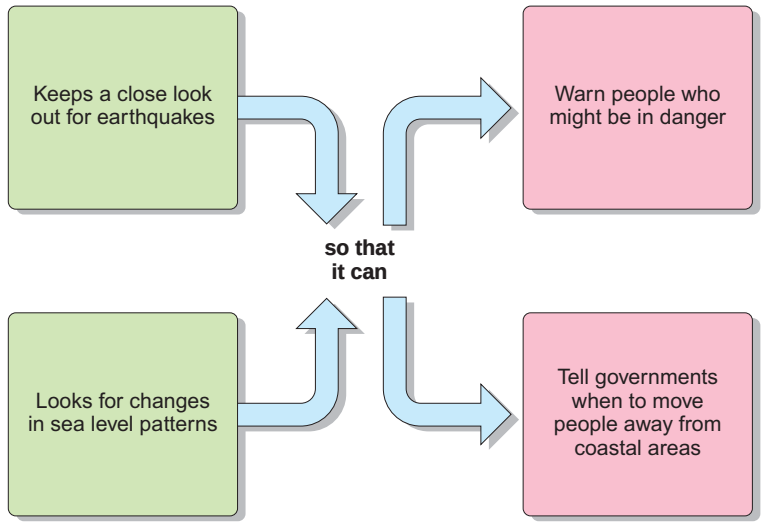
C Devastated coastal area following a tsunami

HOW CAN YOU PREPARE FOR A TSUNAMI?

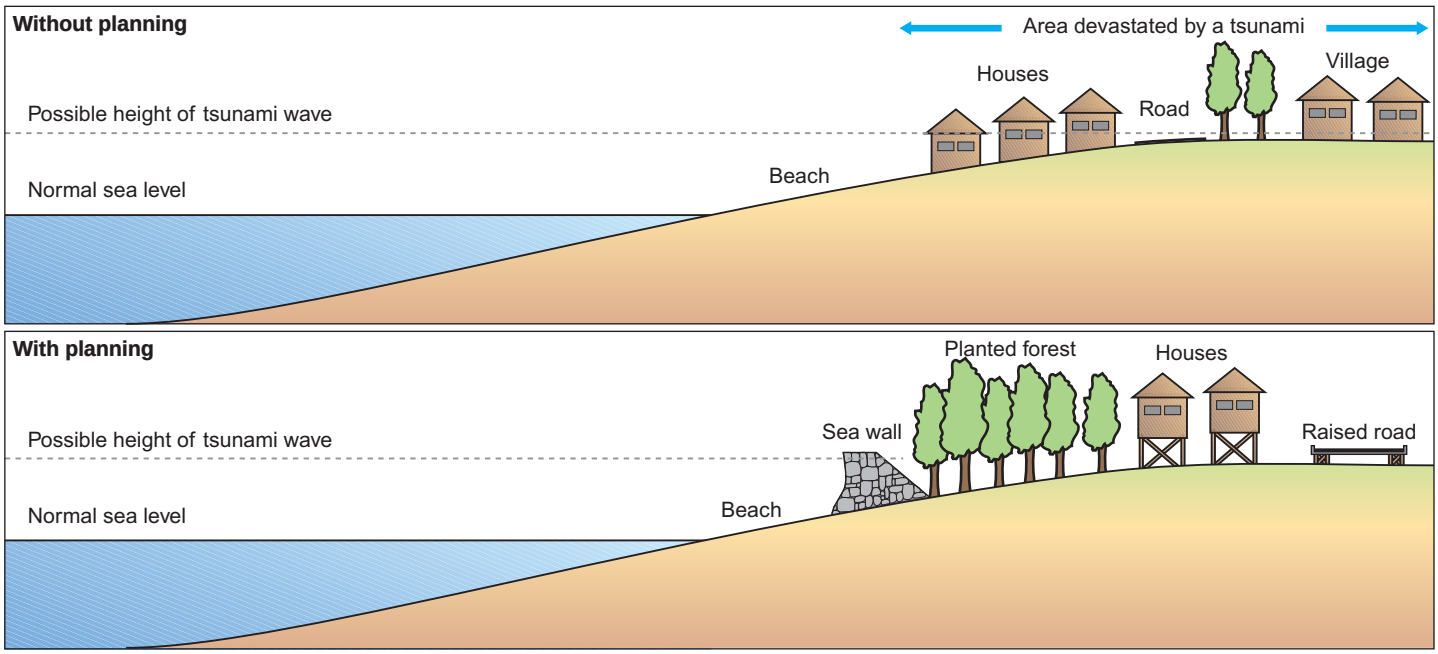
To help some countries prepare for tsunamis, the Pacific Tsunami Warning System was set up. This involves twenty-four countries in the Pacific Ocean area. It is organised from the island of Hawaii, in the centre of the Pacific Ocean (**B**).

PLANNING FOR A TSUNAMI

In richer parts of the world, such as Japan, coastal areas have been changed to help them cope with tsunamis. The diagrams in source **E** show how a coastal area can be changed so that if a tsunami occurs, the damage will be much less.



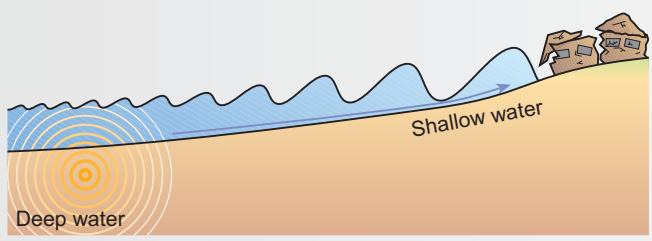
D Pacific Tsunami Warning System



E How planning for a tsunami can help avoid disaster

Activities

1 Draw a sketch like the following one.



Put the words in the box below on your sketch.

Earthquake	Small waves
Large waves	Buildings destroyed

2 What does the word 'tsunami' mean?

3 What has to happen for a tsunami to start?

4 Which part of the world gets the most tsunamis?

5 What are the aims of the Pacific Tsunami Warning System?

6 Describe the ways that a coastal area can be changed to reduce the effect of a tsunami.

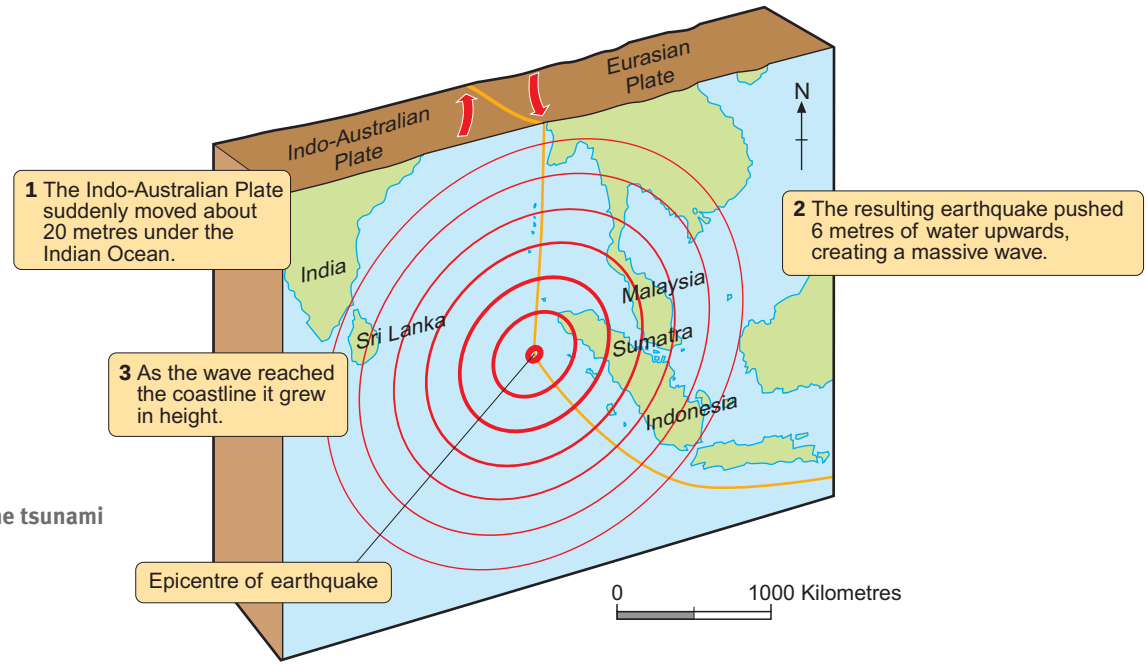
Case study: the Indian Ocean tsunami – December 2004

A Satellite image showing the developing Indian Ocean tsunami

- Understanding that an undersea earthquake can affect places hundreds of miles away
- Finding out about the causes and effects of the Indian Ocean tsunami

On the 26 December 2004 one of the strongest earthquakes ever recorded happened near the coast of north-west Indonesia (photo **A**). The underwater earthquake sent huge waves racing across the Indian Ocean and even reached the coast of East Africa – 4,000 miles away.

WHAT CAUSED THE TSUNAMI?



B The cause of the tsunami

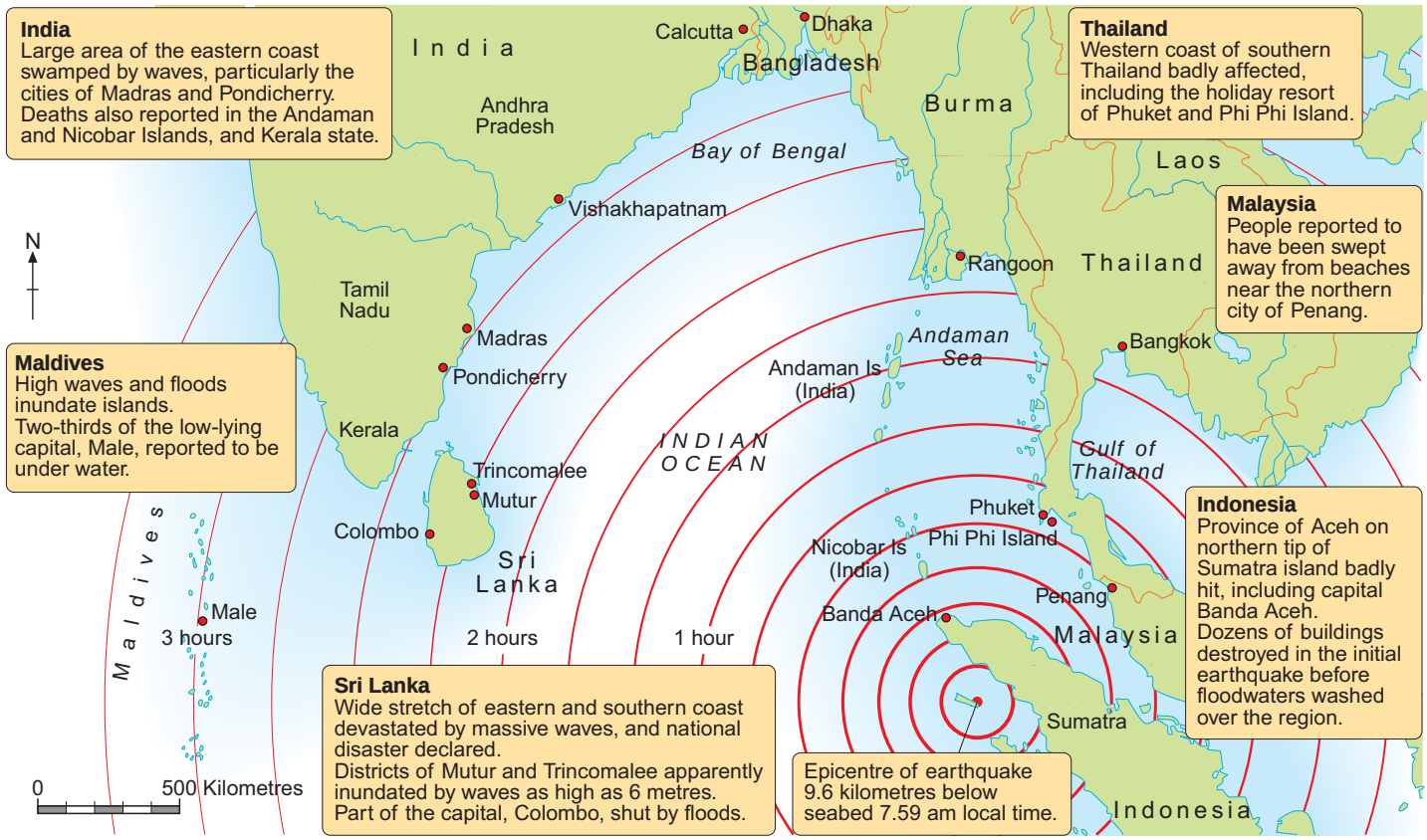
WHAT WAS THE RESULT IN COASTAL AREAS?

FACT FILE

- The tsunami killed over 300,000 people.
- Over 1 million homes were destroyed.
- The waves travelled at over 400 mph out at sea – reducing to 30 mph near land.
- The height of the wave was between 3 and 9 metres.

C Tourists fleeing as the tsunami wave approaches

Map **D** shows the immediate effects of the tsunami as massive waves crashed onto the coastal areas surrounding the Indian Ocean.



D Immediate effects of the tsunami

Source: NI Syndication

Activities

1 Copy out the following points in the correct order to explain what caused the tsunami:

- The sea was pushed upwards.
- The waves moved towards the land.
- There was a massive earthquake.
- Waves were created.

2 a) What are the names of the two plates that moved, creating the earthquake?

b) By how much did the plates move?

3 Put a title 'The effects of the tsunami'.

Copy out and complete the following table, which describes some of the effects of the tsunami in different countries.

Counry	Effects
Sri Lanka	A lot of areas flooded A lot of damage

Living through the Indian Ocean tsunami

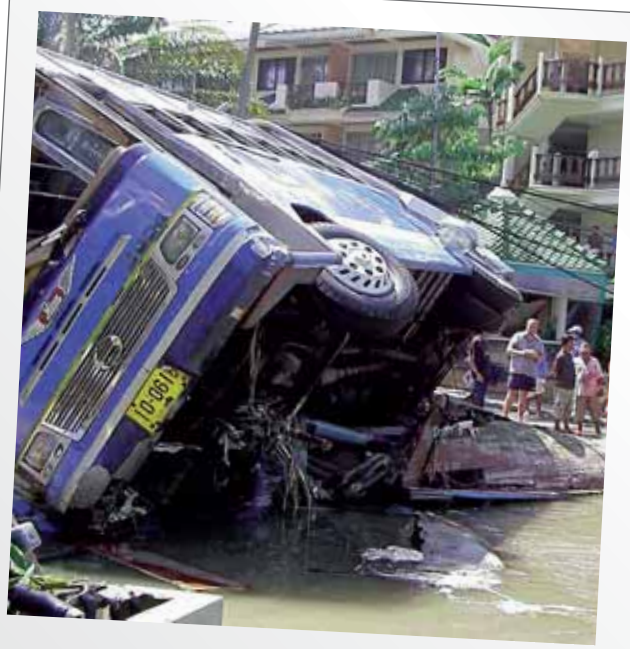
- Learning about how it feels to experience a tsunami
- Understanding that hazards can have both short- and long-term effects

When the tsunami struck the coastal areas surrounding the Indian Ocean millions of people were affected, including thousands of holidaymakers who had gone to the area for a 'sunshine break' during the Christmas holidays. The following resources give an impression of what it was like to live through the tsunami.

Thousands of people were swept to their deaths yesterday as a giant wave hit the holiday beaches of south-east Asia

Beach resorts across the area – from Thailand to Sri Lanka were ripped apart by a wave of water up to nine metres high.

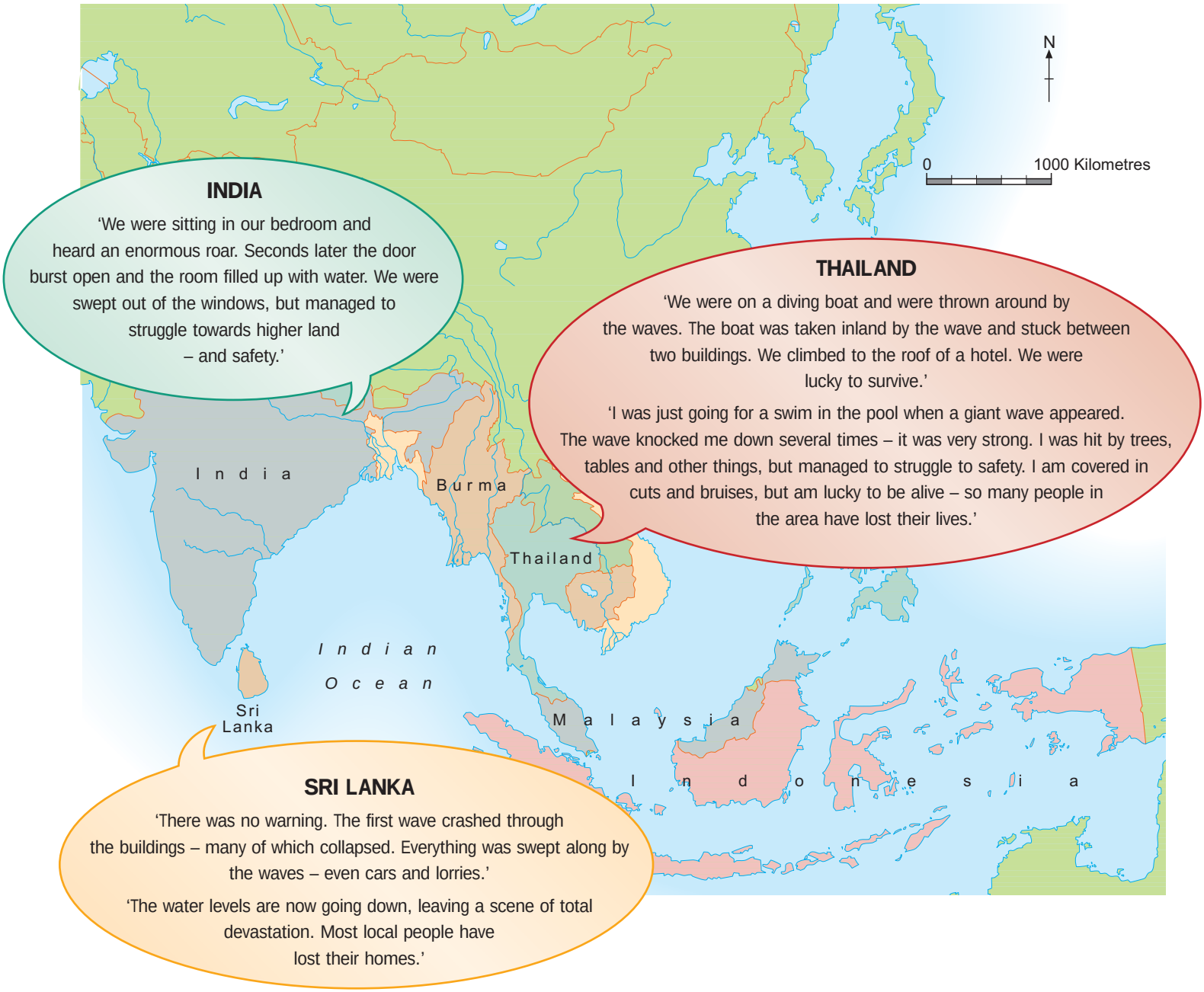
There was little warning as the wave of water swept across the area. People reported a low groaning noise before the waves crashed against the buildings. The waves were so powerful that they totally destroyed buildings and picked up cars and trucks – moving them miles inland.



As millions of people were going about their daily lives, they were totally unaware of the horrors facing them

People were not to know that the gentle swaying of skyscrapers in Singapore was the result of an earthquake which was about to bring a wall of water crashing down on their homes.

Towns and villages have grown up near the beaches, many based on the fishing industry. More recently, the tourist industry has developed with large resorts and holiday homes dotted along the coast. When the wave struck, many of these areas were totally destroyed.



INDIA

'We were sitting in our bedroom and heard an enormous roar. Seconds later the door burst open and the room filled up with water. We were swept out of the windows, but managed to struggle towards higher land – and safety.'

THAILAND

'We were on a diving boat and were thrown around by the waves. The boat was taken inland by the wave and stuck between two buildings. We climbed to the roof of a hotel. We were lucky to survive.'

'I was just going for a swim in the pool when a giant wave appeared. The wave knocked me down several times – it was very strong. I was hit by trees, tables and other things, but managed to struggle to safety. I am covered in cuts and bruises, but am lucky to be alive – so many people in the area have lost their lives.'

SRI LANKA

'There was no warning. The first wave crashed through the buildings – many of which collapsed. Everything was swept along by the waves – even cars and lorries.'

'The water levels are now going down, leaving a scene of total devastation. Most local people have lost their homes.'

A Interviews with British holidaymakers affected by the tsunami

Activities

1 What information do the newspaper reports give about:
- the size of the waves?
- the power of the waves?

2 What happened in Singapore to suggest that an earthquake had occurred?

3 Why do a lot of people live on the coast in this area?

4 Describe what is happening in the photographs on the opposite page.

5 Write a short paragraph to describe the experience of holidaymakers in India, Thailand and Sri Lanka.

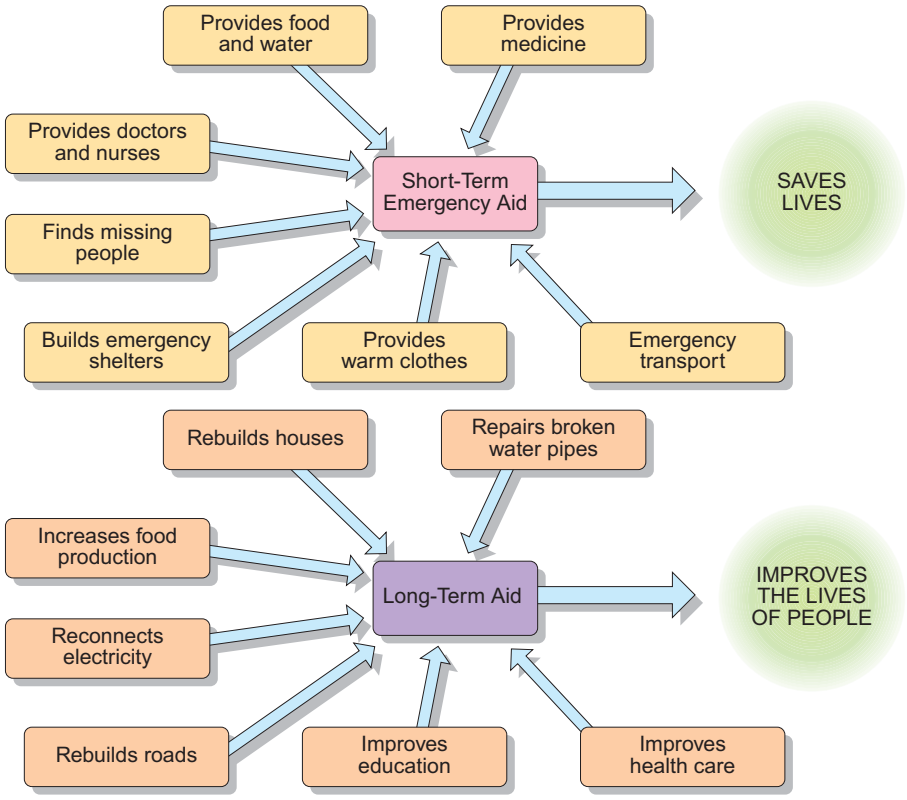
6 The following point was made in a radio interview by an aid worker:

'Many people are drinking dirty water and eating food picked up from the streets. They are also having to sleep in the open.'

What problems might this cause for people in the next few weeks?

Helping people after a natural disaster

- Understanding the importance of aid after a natural disaster
- Finding out about the different types of aid needed after a natural disaster



A How aid can help

After a natural disaster poor countries often need a lot of help, first to cope with the disaster and then to rebuild the damaged areas.

Immediate problems might include lack of food, clean water or medicines. Once those problems are sorted out, rebuilding can begin. This might involve rebuilding roads, bridges or even whole towns.

One way of helping countries is by giving aid (**A**). There are two main types of aid:

1 Government aid: this is money given by one government to another government (**B**).

2 Voluntary aid: this is money given by charities like Oxfam, the Red Cross/Red Crescent or Christian Aid. Charities are called Non-Governmental Organisations or NGOs.

HOW DID AID HELP PEOPLE AFFECTED BY THE INDIAN OCEAN TSUNAMI?

Government aid

Japan	£260m
USA	£180m
UK	£50m
Sweden	£40m
Spain	£35m
China	£31m
France	£30m
Taiwan	£26m
Australia	£24m
Canada	£17m

B Money given by different countries after the tsunami

1500 American soldiers and 20 helicopters were sent to the area to help distribute food and water.

The Japanese government gave millions of pounds – much of which was used to supply food, shelter and medical help.

Soldiers and heavy machinery from many countries were flown in to help clear roads and airports.

Doctors, nurses and medical equipment were sent to the area from a number of countries.

C Aid in action

VOLUNTARY AID

The following diagram shows some of the help given by charities after the Indian Ocean tsunami.

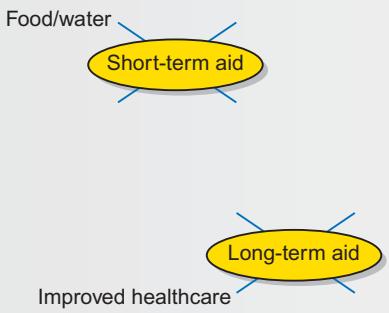
D Some of the help given by charities after the tsunami

E Voluntary aid in action

Activities

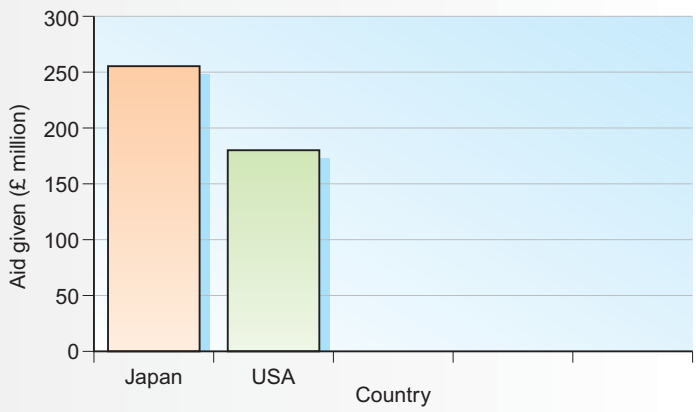
1 What is meant by:
- government aid?
- voluntary aid?

2 Copy out and complete the spider diagrams to show how aid can help countries.



3 Describe some of the help given by World Vision and the Red Cross after the tsunami.

4 Copy out and complete the following graph to show the money given by the top five countries.



5 Use Google to look up *two* of the charities mentioned on the internet. For each:
- write down the full name/web address
- describe *two* aid projects they are involved with.

Why do people live in active areas?

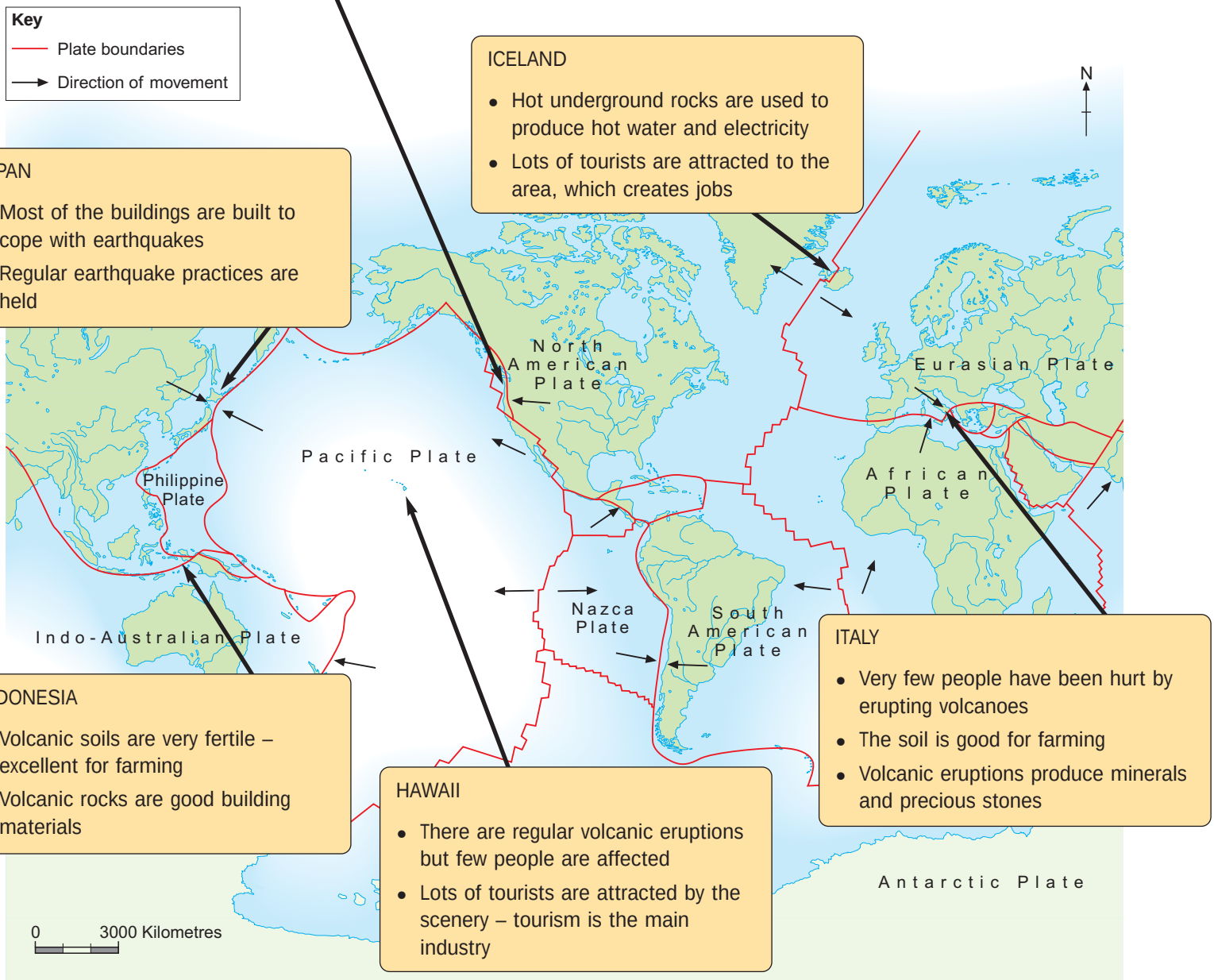
- Learning that there are advantages to living in active tectonic areas
- Understanding that people who live in active areas learn to adapt to them

Looking at a world map it is easy to see that several of the world's largest cities, including Tokyo, Mexico City and Los Angeles are in active earthquake areas. One reason people live in these areas is that earthquakes and volcanoes don't happen very often, so they feel that they will be safe. Also, if you have always lived in an area and it is where your family and friends are, it is difficult to move away.

There are lots of reasons why people live in active areas, some of which are shown below and in the travel report about Nicaragua.

CALIFORNIA (USA)

- Excellent climate for outdoor living
- Fantastic beaches for leisure activities
- Highly paid jobs
- The area is well prepared for earthquakes



ICELAND

- Hot underground rocks are used to produce hot water and electricity
- Lots of tourists are attracted to the area, which creates jobs

JAPAN

- Most of the buildings are built to cope with earthquakes
- Regular earthquake practices are held

INDONESIA

- Volcanic soils are very fertile – excellent for farming
- Volcanic rocks are good building materials

HAWAII

- There are regular volcanic eruptions but few people are affected
- Lots of tourists are attracted by the scenery – tourism is the main industry

ITALY

- Very few people have been hurt by erupting volcanoes
- The soil is good for farming
- Volcanic eruptions produce minerals and precious stones

The following travel report is from a holiday magazine.

TRAVEL REPORT

JOURNEY AMONG THE VOLCANOES

Nicaragua is a country in Central America about the size of England. It is an active volcanic region of deep valleys and giant waterfalls. The volcanic soil and heavy rainfall make the country very green and there is a great variety of flowering plants and animals. There are a number of volcanoes in the country, including Cerro Negro, Nicaragua's most active volcano. Climbing its cone is hot work, but gives fantastic views over the surrounding countryside. Further south, a road leads to the edge of the crater of Volcan Masaya, where a sign helpfully tells you to 'shelter under your car in the event of an eruption'! The volcanic cone at Cerro Negro was formed in 1998; my guide said you can bike, ski, or surf down the hot ash – but I chose to walk!

This small area has everything for a holiday, great beaches, a hot climate, good quality hotels and the bonus of the fantastic scenery – why not give it a try!

Activities

1 What is meant by the term: 'active area'?

2 Name *three* large cities found in 'active areas'.

3 Copy out and complete the table below by adding examples from *three* more countries.

Why people live in active areas	
Place	**Reason**
Italy	Safe area – few people hurt by erupting volcanoes Good soil for farming

4 Nicaragua seems an exciting place to go for a holiday.

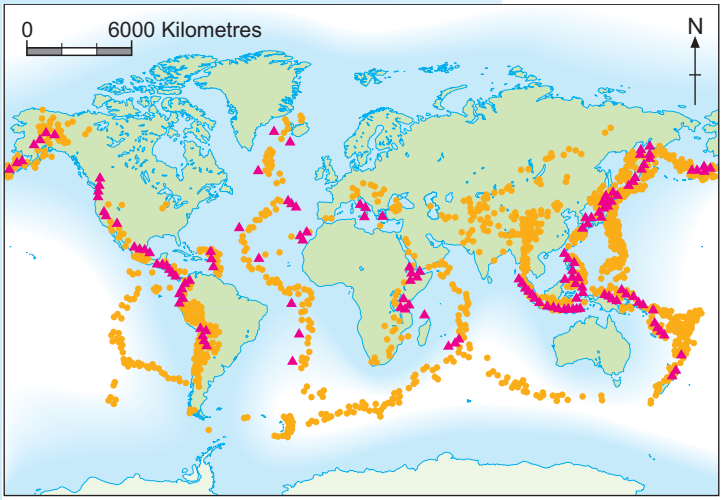
a) List *three* reasons why people might visit Nicaragua.

b) Explain why *one* of your reasons might attract you to Nicaragua.

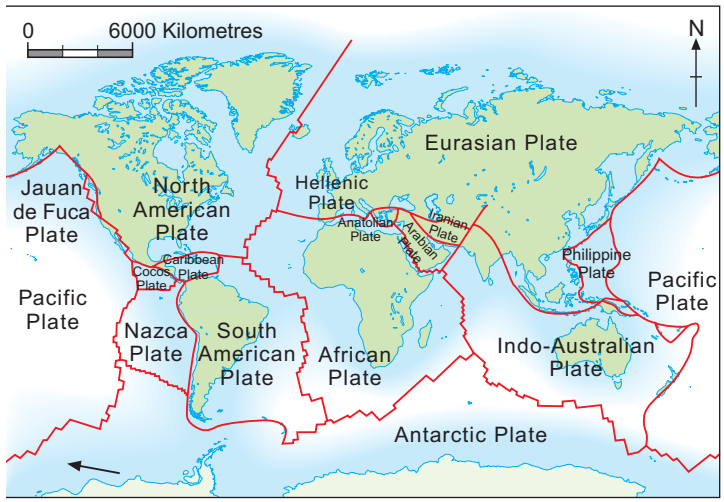
5 Explain why tourism is so important in some areas.

6 **Research task** Use an atlas, travel brochures or the internet (see Hotlinks, page ii) to identify different tourist locations in volcanic areas.

Living with earthquakes and volcanoes



A World map showing earthquakes and volcanoes



B World map showing plates

1 The location of earthquakes and volcanoes.

a) Compare the location of earthquakes and volcanoes (**A**) with the position of the earth's plates (**B**).

b) Why do earthquakes and volcanoes occur at plate boundaries?

2 The effects of earthquakes and volcanic eruptions.

EARTHQUAKE STRIKES INDIA

People in northern India are trying to recover from the worst earthquake in nearly 50 years. An estimated 20,000 people are thought to have died and thousands more are injured or missing. Worst hit was the city of Bhuj. Whole areas were flattened. In villages surrounding the city many farms have been destroyed. Thousands of people are homeless and emergency services are trying to provide food, water and medical help. There is a growing threat of disease.

C Indian earthquake – newspaper report

Using source **C**:

a) Describe the effects of the Indian earthquake.

b) Why are poor countries often more badly affected by earthquakes?

3 Reducing the effects of earthquakes and volcanoes.

a) How could predicting earthquakes and volcanoes help to reduce their effects?

b) List *four* things you might include in an emergency earthquake kit. Explain your choices.

4 The importance of aid after natural disasters.

a) What sorts of emergency aid are often helpful immediately after an earthquake or volcanic eruption has happened?

b) After an earthquake poorer countries are often given help to:

- rebuild homes
- repair water pipes
- repair roads

Explain why any *one* of these is important.