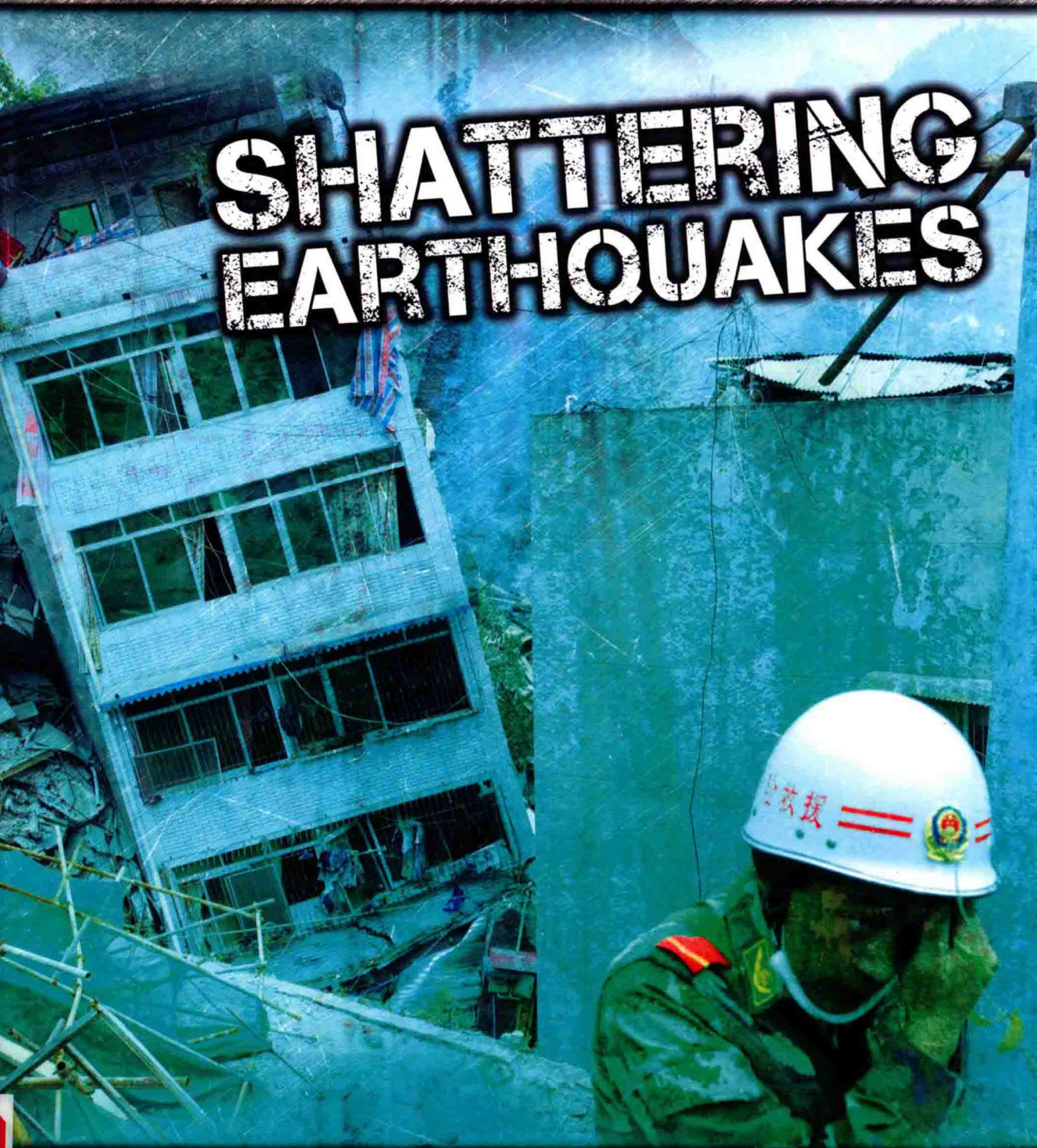


AWESOME FORCES OF NATURE



SHATTERING EARTHQUAKES



AWESOME FORCES OF NATURE

SHATTERING EARTHQUAKES

Revised and updated



Louise and Richard Spilsbury





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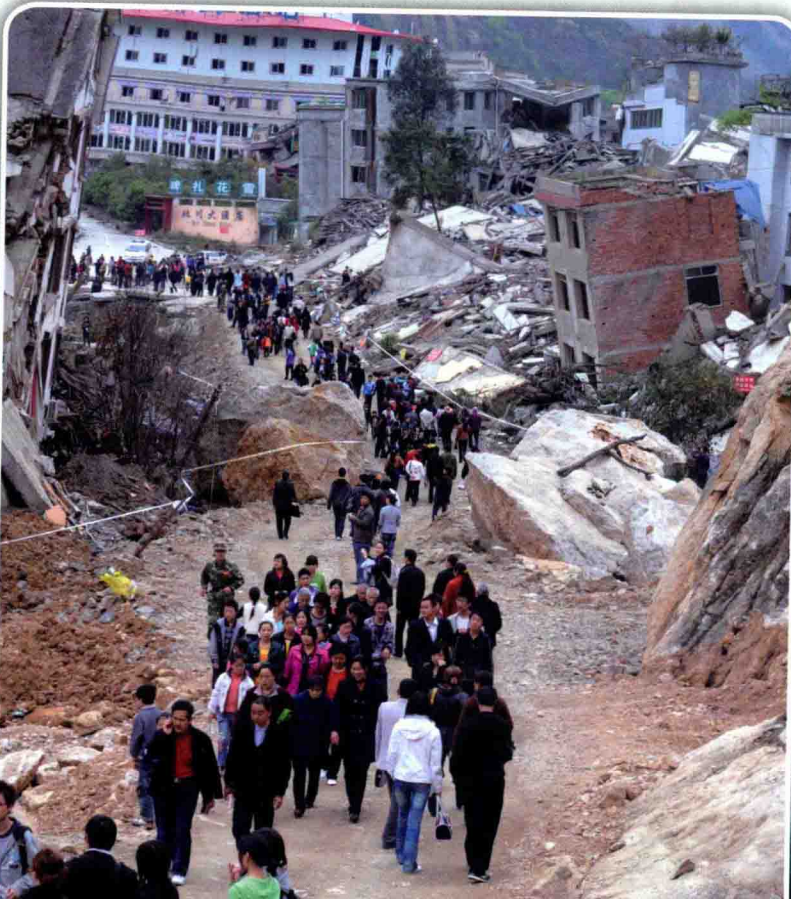
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What is an earthquake?

Imagine you are reading at a table. You notice that the clock and your glass are beginning to wobble. Then you hear a rumbling sound, like a jet aeroplane flying above the house. Objects in the room rattle and shake more and more. Then, suddenly, your whole room jerks, knocking things off the table and pictures off the walls.

This is how it can feel in an earthquake. An earthquake is when the surface of the Earth moves. The ground under our feet usually feels solid but during an earthquake it shakes, cracks open and dips. Most earthquakes are very small and people may only feel a slight trembling under their feet. Others can make cracks in walls and jolt books off shelves. The worst earthquakes in the world cause terrible destruction.



The earthquake on 12 May 2008 in China's Sichuan Province caused massive amounts of damage to buildings and roads.



The huge cracks in this road were caused by an earthquake.

EARTHQUAKE FACTS

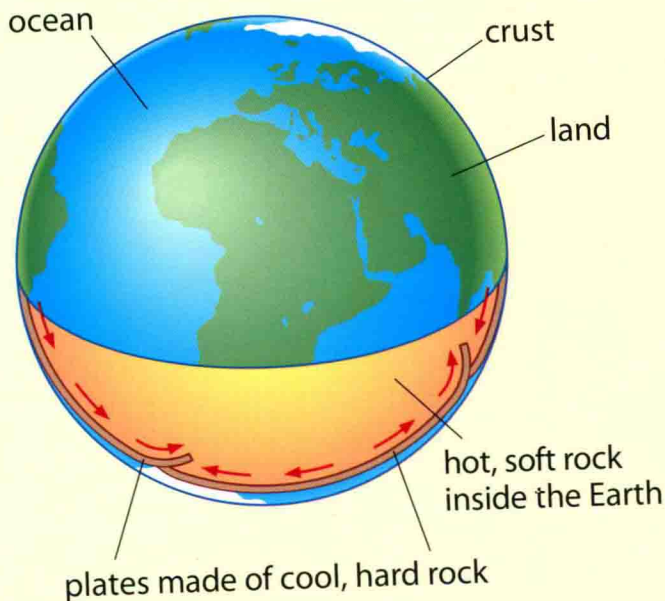
- 1 Earthquakes cause more damage than any other kind of natural disaster.
- 2 Several million earthquakes happen around the world each year. But most are so small that people cannot even feel them.
- 3 Most earthquakes last for less than a minute, but people can often feel them over a huge area.

Large earthquakes can transform huge areas of the Earth in an instant. During a major earthquake, the shaking of the Earth can knock down buildings, break open roads and bridges, and make huge cracks appear in the land. Cars, buildings and whole lakes can disappear into these cracks.

What causes earthquakes?

Earthquakes are movements of the ground. They usually happen in certain places because of the way the Earth is made. To understand how earthquakes happen, you need to know a bit about how our planet is formed.

The surface of the Earth is made of a layer of hard rock. This layer forms the land and the floor of the oceans. It is called the **crust**. Under the crust there is more rock. Millions of years ago, this rock cracked, like the shell of an egg. It split into giant pieces called **plates**. These plates float like huge rafts on hot, liquid rock that bubbles deep inside the Earth. They move very, very slowly around the Earth.



The Earth's plates are pieces of rock under the Earth's surface that fit together rather like panels on a football.

Moving plates

As the plates move, they rub or slide against each other. The place where plates meet is called a **fault**. In most places, one plate slides against another in a slow and steady way. Most plates move at a speed of only a few centimetres each year – that's about the same rate of growth as your fingernails!

Sometimes two plates get stuck against each other. For many years they slowly push harder and harder against each other. Then, suddenly, the force becomes too much and these gigantic plates of rock slip past each other. When this happens, the crust above shudders and shakes too. This is an earthquake. The force of the plates suddenly jerking apart can open cracks in the crust above and around the fault.



Fault lines are usually deep underground, but some can be seen on the surface. This is the San Andreas Fault. It runs down the west coast of North America.

Shock waves

The point on the Earth's surface above the start of an earthquake is called the **epicentre**. The force of an earthquake spreads out in waves from the epicentre in all directions. These movements are called **shock waves**. Shock waves ripple through the rocks all round the epicentre like ripples on a pond when you throw in a stone. Shock waves can travel for hundreds of kilometres, but they get weaker as they get further away from the epicentre.

Aftershocks

Earthquakes usually happen in groups. A major earthquake may start off with small earth **tremors** (movements) that gradually get stronger. These may happen several days before the main earthquake happens. After the main quake, there may be **aftershocks**. Many are too small to feel, but others are like smaller earthquakes. They usually occur within a few days, getting weaker over time.



This damage was caused by the aftershocks that followed a 2009 earthquake in Italy.

Measuring earthquakes

Earthquakes are measured on the **Richter scale**. It is based on the amount of damage they cause. The higher the number on the scale, the more powerful the earthquake is. The weakest earthquake is rated 1 and the strongest earthquake possible would be rated a 10.

What do the ratings mean?

- 2.0 or below – people above ground cannot feel an earthquake like this and it is not recorded.
- Below 4.0 – earthquake can be felt but usually causes little or no damage.
- Over 5.0 – earthquake will be felt by all and could cause some damage.
- Over 6.0 – earthquake that can cause serious damage to buildings.
- Over 7.0 – major earthquake that causes severe damage and can topple buildings over a wide area.
- Over 8.0 – earthquake that causes very severe damage or almost total destruction over a wide area.



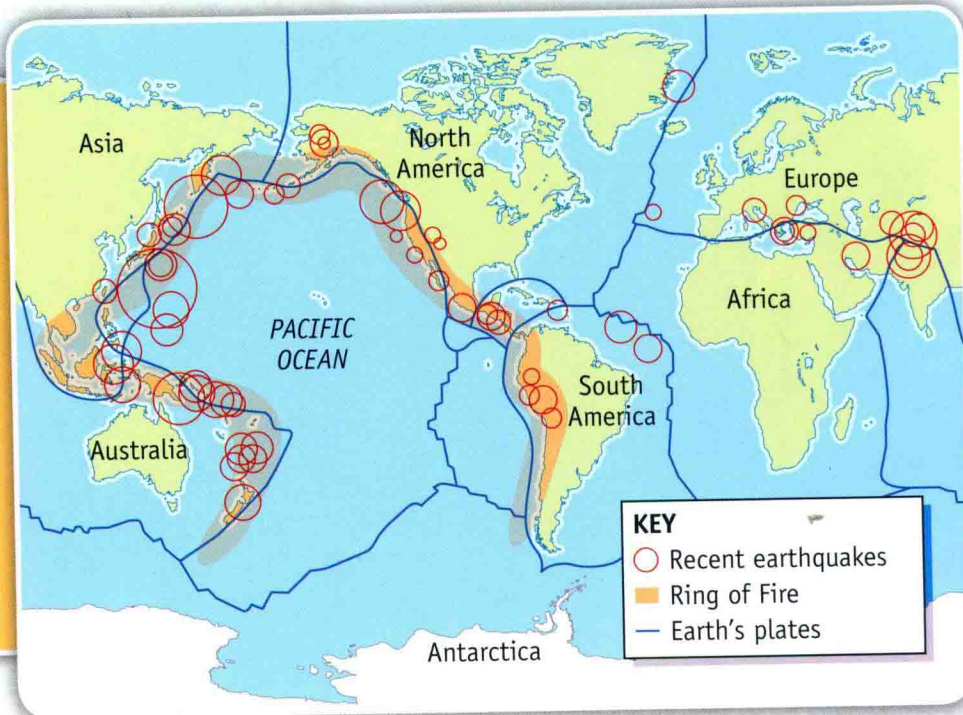
On 17 August 1999 an earthquake shook the cities of Izmit and Istanbul in Turkey. It measured 7.4 on the Richter scale and caused terrible damage.

Where do earthquakes happen?

Earthquakes can happen all over the Earth, on land or on the ocean floor. Some earthquakes happen in the middle of **plates**. They happen in places where there is a line of weakness in the Earth's **crust**. But most earthquakes happen where two of the Earth's plates meet.

Many earthquakes happen around the edges of the Pacific Ocean. This is where several plates meet and where hot liquid rock can escape to the surface. This means that many earthquakes and **volcanoes** happen in this area, which has been named the 'Ring of Fire'. Another area that suffers from many earthquakes is a zone that runs from Italy and Greece, through central Asia and the Himalayas.

This map shows the area where most of the earthquakes on Earth happen. The red circles mark places where some of the most damaging earthquakes of recent years have happened. Four out of every five earthquakes occur in the Ring of Fire.



CASE STUDY

West Midlands, UK, 2002

Earthquakes can happen in all sorts of places. Few people think of the UK as a country that has earthquakes. In fact, the UK has quite a powerful earthquake every ten years or so. One recent earthquake began at around 1 a.m. on 23 September 2002. Thousands of people woke up to feel their houses and furniture shaking and their windows rattling. The earthquake measured 4.8 on the **Richter scale** and its **epicentre** was in Dudley in the West Midlands. It shook buildings in parts of the West Midlands, Wales, North Yorkshire, London and Wiltshire for up to 30 seconds.

“*The house started shaking quite violently. All the power was cut off. Quite a few people came out of their houses wondering what was going on. The streets were in darkness.*”

Richard Flynn, West Midlands

”



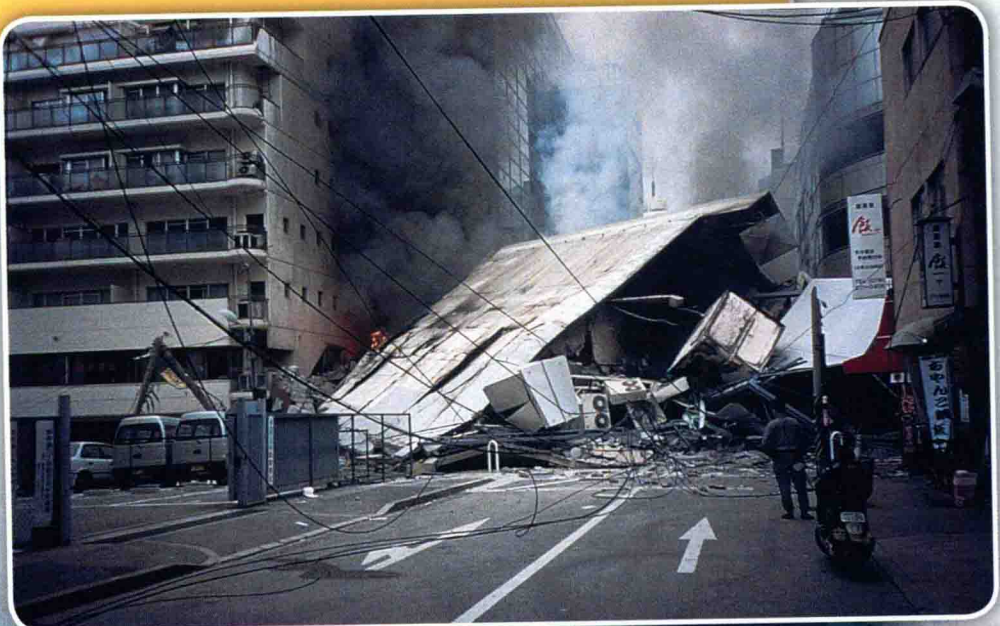
No-one was hurt in the West Midlands earthquake, but there was some minor damage.

What happens in an earthquake?

Earthquakes usually do most damage at the **epicentre**, but **shock waves** can make land for miles around shake and tremble. In a severe earthquake, the ground can rise and fall like waves in the sea. In the worst cases, the entire shape of the land can be changed.

When an earthquake shakes the ground, it can make walls crack and roofs fall in. If one building falls, it can make the one next to it collapse too. When earthquakes jolt the ground they can break electricity cables and gas pipes. Sparks from electricity cables can cause fires and leaking gas can cause explosions. Earthquakes can rip apart roads and crack and bend bridges. **Aftershocks** bring yet more damage. They make things that were weakened by the first earthquake fall down.

In 1995 an earthquake in Kobe, Japan killed over 5000 people. Many people died because the roofs of buildings collapsed on them.



CASE STUDY

Mexico City, 1985

Earthquakes can change landscapes by opening cracks in the Earth and changing land levels. They can also turn firm land into soft, dangerous land.

On 19 September 1985, a huge earthquake hit Mexico City. The epicentre was 50 kilometres off the coast in the sea. However, the quake still rated 8.1 on the **Richter scale** when it reached Mexico City, over 300 kilometres inland. The earthquake was so bad because the city sits on soil made of soft sand and clay. The shock waves shook the soil grains apart, turning it into quicksand. This caused buildings to tilt, shift, or even sink into it. Over 10,000 people were killed, over 40,000 people were injured, and around 100,000 people were left homeless.



Once the dust clouds had cleared, it became obvious that much of Mexico City had been reduced to rubble.