EARTHQUAKES

www.geolsoc.org.uk/earthquakes

2017 YEAR OF RISK

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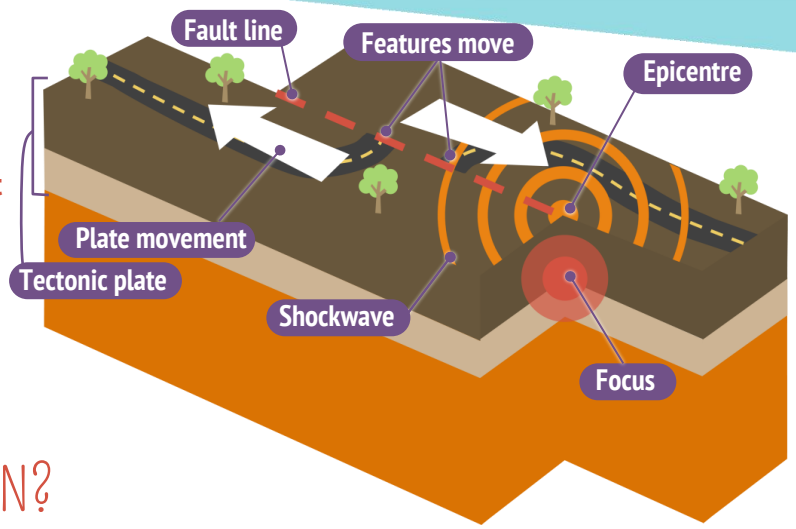
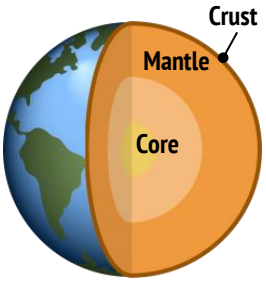
Building damage from the L'Aquila earthquake, Italy 2009; collapsed building in Haiti 2010, earthquake damage in Northern Honshu, Japan 2011; San Andreas Fault, California, USA.

Earthquakes are natural vibrations caused by sudden movements in the Earth's crust. Although most earthquakes are small, the most powerful quakes can flatten cities and kill thousands of people. Geologists study earthquakes to understand where they are likely to happen and how people can be prepared and protected when an earthquake



WHERE DO EARTHQUAKES HAPPEN?

The Earth's surface is split into huge slabs of rock called **tectonic plates** made from the Earth's rocky **crust** and the upper parts of the **mantle**. Tectonic plates fit together like a jigsaw puzzle and move around on top of the Earth's mantle. Most earthquakes occur at **plate boundaries**, the zones where two, or more, plates meet. This is especially true for the **Pacific Ring of Fire**, an area around the Pacific Ocean where over 80% of the earthquakes on Earth occur.



Map showing the distribution of earthquakes (yellow dots) on Earth. Most earthquakes occur at or near the Earth's tectonic plate boundaries (red lines).

WHAT CAUSES AN EARTHQUAKE?

The edges of tectonic plates are jagged and rough. This means that when they push and grind past each other, they generate lots of **friction** and blocks of rock can sometimes become locked together. When this happens, the energy that would normally cause the blocks to move past each other is stored up. Eventually the **stress** builds up so much that the plates suddenly jolt into a new position. This movement releases energy which travels through the Earth as **seismic waves**, shaking the surface, including anything on it. This is an earthquake. The point at which the earthquake occurs below the Earth's surface is called the **focus**, the point directly above the focus on the Earth's surface is known as the **epicentre.**

EARTHQUAKE HAZARDS

Where an earthquake occurs affects the damage it can cause. Earthquakes can cause buildings to collapse, often killing or injuring the people trapped inside. They can destroy roads, railways and electricity cables which can delay communications and rescue attempts. Earthquakes can also trigger other **natural hazards** including **rock falls**, **landslides**, **tsunamis** and even **volcanic eruptions**.

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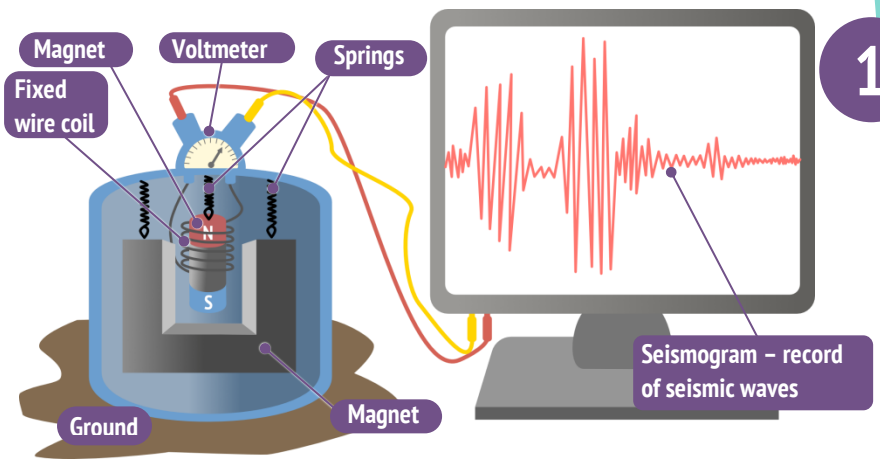
HOW DO WE MEASURE EARTHQUAKES?

The size of the earthquake is called its **magnitude**. The bigger the earthquake, the more energy released and the bigger the earthquake's magnitude. The amount of shaking will vary depending on where you are during an earthquake; but there is only one magnitude for each earthquake. Geologists record the magnitude of earthquakes using instruments called **seismometers**. Seismometers measure the shaking from seismic waves and plot these as a **seismogram**.

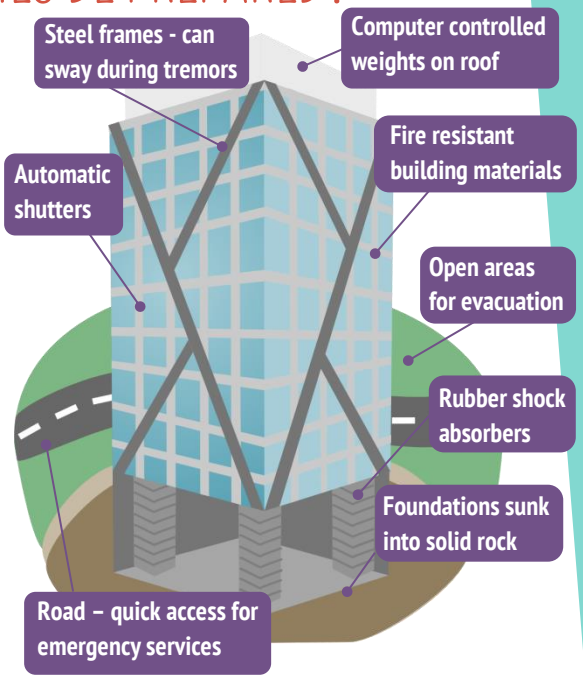


Simple seismometer: as the ground shakes during an earthquake, the **magnets** (on springs) do not move but the fixed wire coil moves with the container. This generates an **electrical current** in the wire coil, which can be measured using a **voltmeter** and displayed on a computer screen as a seismogram.

Geologists use **magnitude scales** to measure and compare the magnitudes of different earthquakes. Earthquakes with a magnitude of less than 5 rarely damage buildings. However earthquakes with a magnitude of 6 or more can be catastrophic. The largest earthquake ever recorded was in Chile in 1960 and had a magnitude of 9.5.

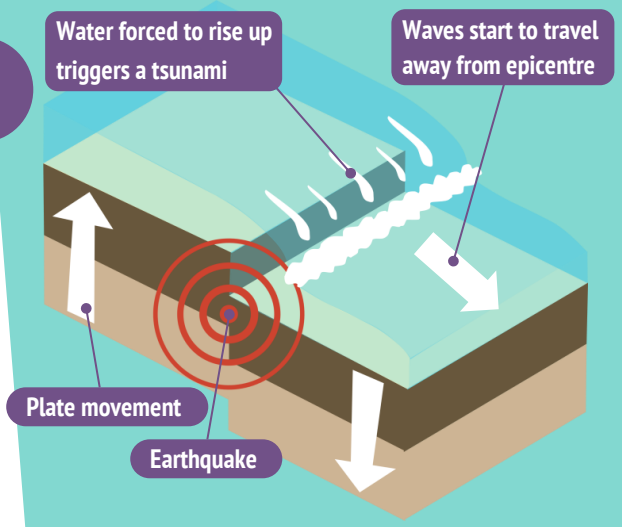
HOW CAN COUNTRIES BE PREPARED?

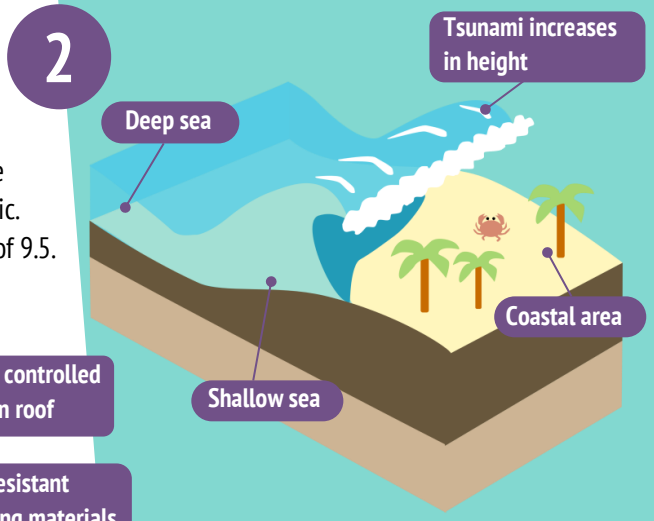
Geologists know where earthquakes are likely to happen but it is impossible to **predict** when an earthquake will occur. It is therefore important for earthquake-prone countries to be prepared at all times. **Engineering** that allows buildings to 'wobble' instead of remaining stationary can help stop buildings collapsing and therefore potentially save thousands of lives during a large earthquake. Educating the public is also very important so that people know what to do if they feel an earthquake. Generally staying indoors under a sturdy table or doorframe is the safest thing to do.



TSUNAMIS

If the ocean floor moves suddenly in an earthquake it can cause the water above to form a series of huge waves called a **tsunami**. Tsunamis spread out very quickly across the ocean (reaching speeds of up to 800km/hour!). Out in the ocean tsunami waves are usually about 30cm high, however as they get closer to land, the sea becomes shallower and the tsunami waves are forced to slow down and increase in height, sometimes up to 40m!





When tsunamis reach land they can destroy buildings, **flood** whole cities and kill and injure many people. It is therefore extremely important to educate people in tsunami-prone regions so they know how to stay safe when a tsunami occurs. The best method for survival is for people to quickly get themselves to higher land. Coastal communities can also reduce the **risks** of tsunamis by planting more trees along the coastline to break up tsunami waves, constructing buildings on stilts and building tall platforms for people to get out of a tsunami's path at short notice.