

# YEAR 10 UNIT 2: Tectonic Hazards

## What is a natural hazard?

A natural hazard is a natural process which could cause death, injury or disruption to humans, property and possessions.

**Geologic Hazards** - These are hazards caused by land and tectonic processes.

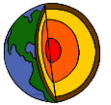
**Meteorological Hazards** - These are hazards caused by weather and climate.

## Structure of the Earth

**The Crust** - Varies in thickness (5-10km) beneath the ocean. Made up of several large plates.

**The Mantle** - Widest layer (2900km thick). The heat and pressure means the rock is in a liquid state that is in a state of convection.

**The inner and Outer Core** - Hottest section (5000 degrees). Mostly made of iron and nickel and is 4x denser than the crust. Inner section is solid whereas outer layer is liquid.



## Types of Plate Margin

**Destructive Plate Margin** - When the denser plate subducts beneath the other, friction causes it to melt and become molten magma. The magma forces its way up to the surface to form a volcano. This margin is also responsible for devastating earthquakes.

**Constructive Plate Margin** - Here two plates are moving apart causing new magma to reach the surface through the gap. Volcanoes formed along this crack cause a submarine mountain range such as those in the Mid Atlantic Ridge.

**Conservative Plate Margin** - A conservative plate boundary occurs where plates slide past each other in opposite directions, or in the same direction but at different speeds. This is responsible for earthquakes such as the ones happening along the San Andreas Fault, USA.



## Convection Currents

The crust is divided into tectonic plates which are moving due to convection currents in the mantle.

1. **Radioactive decay of some of the elements in the core and mantle generate a lot of heat.**
2. When lower parts of the mantle molten rock (Magma) heat up they become **less dense** and **slowly rise**.
3. As they move towards the top they cool down, become **more dense** and **slowly sink**.
4. These **circular movements** of semi-molten rock are **convection currents**
5. Convection currents create **drag** on the base of the tectonic plates and this causes them to move.

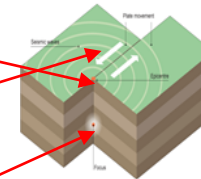
## Causes of Earthquakes

Earthquakes are caused when two plates become locked causing friction to build up. From this stress, the pressure will eventually be released, triggering the plates to move into a new position. This movement causes energy in the form of seismic waves, to travel from the focus towards the epicentre. As a result, the crust vibrates triggering an earthquake.

The point directly above the focus, where the seismic waves reach first, is called the **EPICENTRE**.

**SEISMIC WAVES** (energy waves) travel out from the focus.

The point at which pressure is released is called the **FOCUS**.



### Reasons for living with the risk from tectonic hazards

- Earthquakes and eruptions don't happen very often and not seen as a great threat
- People that live in risk areas in LICs may have no choice but to live with the risk
- HICs may have developed technology to reduce risk eg better building design
- HICs can monitor volcanic activity and tsunami therefore reducing the risk to life
- In volcanic areas soil is fertile which helps farming, there are rich minerals (gold etc) due to the heat and pressure under ground, and hot water can be used to heat buildings (90% Iceland's buildings have Geothermal heating)
- Tourism for volcanoes
- Areas may be highly populated cities where employment is found

### Japan 2011

**Cause** - 2.46pm local time. March 11th 2011. Richter Scale 9.1.

Epicentre 43 miles north east of Tohoku, Japan. Destructive plate margin – the Pacific plate subducted below the collection of continental plates Japan is on. It is believed it slipped 80m around 24 km below the surface. The result was a tsunami that reach 40m high in Miyako and 30ft in Sendai and Tohoku. There was an upthrust of 6-8 at the focus. Tsunami arrived between 10 and 30 minutes after the earthquake

**Primary and Secondary Effects** - Tsunami and shaking killed 15,000 people, 6000 injuries and in 2015 2500 were still reported as missing. Sendai coast line dropped by 1m which allowed the tsunami to breach the 11 m high wall. Fukushima nuclear power station went into melt down and leaked radiation into the sea. 10km evacuation zone was put in place immediately. 127,000 buildings totally destroyed, 330,000 half destroyed and 750,000 partially destroyed. Honshu, the main island of Japan was moved 2.4m east and the earth's axis was shifted between 10cm and 25cm and it increased the earth's rotational speed. In 2015 some 230,000 people were still living away from their homes. By 2016 there had been over 1000 aftershocks 860 of them over Richter scale 5 – they have been linked to decreasing health in Japan. \$300,000,000,000.

**Responses and Management** - 116 countries and 28 international organizations offered assistance. Japan requested assistance from Australia, New Zealand, South Korea, and the United States. The Japanese Red cross said they received \$1 billion in donations to provide shelters and healthcare. Temporary housing pods were put up for people to live in. Sea walls needed reinforcing in coastal areas especially around Power plants. Banning of fishing in the affected areas due to increased caesium levels in the fish – poisonous.

### Nepal 2015



**Cause** - 25th April 2015. 7.9 Richter scale. Epicentre 80km from Kathmandu (capital city). Destructive plate margin – Indo – Australian plate colliding with the Eurasian plate. This plate margin created the Himalaya mountains. Focus was 15km below the surface. Severe ground shaking, avalanches and mudslides caused. Nepal GDP/Capita 109th/193 countries. HDI 145th/187 countries

**Primary and Secondary Effects** - 9000 deaths, 20000 injuries, 8,000,000 affected (1/3 population). 3 million homeless for months, electricity, water and sanitation cut off – risk of cholera and no heating. no organisation meant aid efforts were stuck in the airport for days. 50% of shops destroyed = less income and food supply. 1.4 million needed food, water and shelter for weeks after the EQ. Landslide blocked Kali Gandaki river caused flooding in villages - people evacuated. Langtang – avalanche – 250 missing. Many mountain roads blocked by landslides so villages could not be aided. \$5 billion cost. The rescue team was housed in the oldest building in Kathmandu – they were trapped and needed rescuing themselves – poor planning slowed down the rescue attempt.

**Short and long Term Responses** - UK, India and China sent S and R teams, water and medical support. ½ million tents sent. Financial aid pledged by many HICs. 300,000 people migrated from Kathmandu to seek shelter with family and friends. Field hospitals set up by Red Cross to relieve pressure on damaged hospitals. 7000 schools rebuilt, homes were rebuilt and new buildings built with tighter building controls. June 2015 Nepal hosted a conference to discuss reconstruction and gain financial support. All roads repaired and landslides cleared. All lakes formed by blocked rivers had to be drained to avoid flooding. 2015 Tourism was boosted to bring people back to the country to replace GDP

### Managing the risk from tectonic hazards

Management strategies can reduce the number of people killed, injured, made homeless or made unemployed;

**Monitoring** – Networks of seismometers and lasers monitor earth movements.

**Prediction** – Earthquakes cannot be reliably predicted but monitoring can help forecasting so preparation can occur.

**Protection** – Buildings designed to withstand earthquakes. Bridges can be strengthened so they don't collapse under the weight of ash.

**Planning** – People can be educated so they know what to do. Emergency services can train and prepare for disasters.