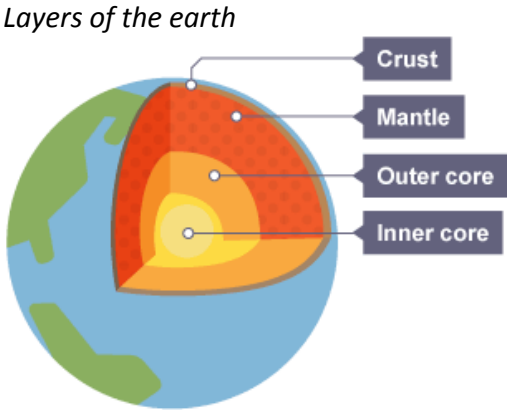
Earthquakes and volcanic eruptions are the result of physical processes.

Plate tectonics theory.

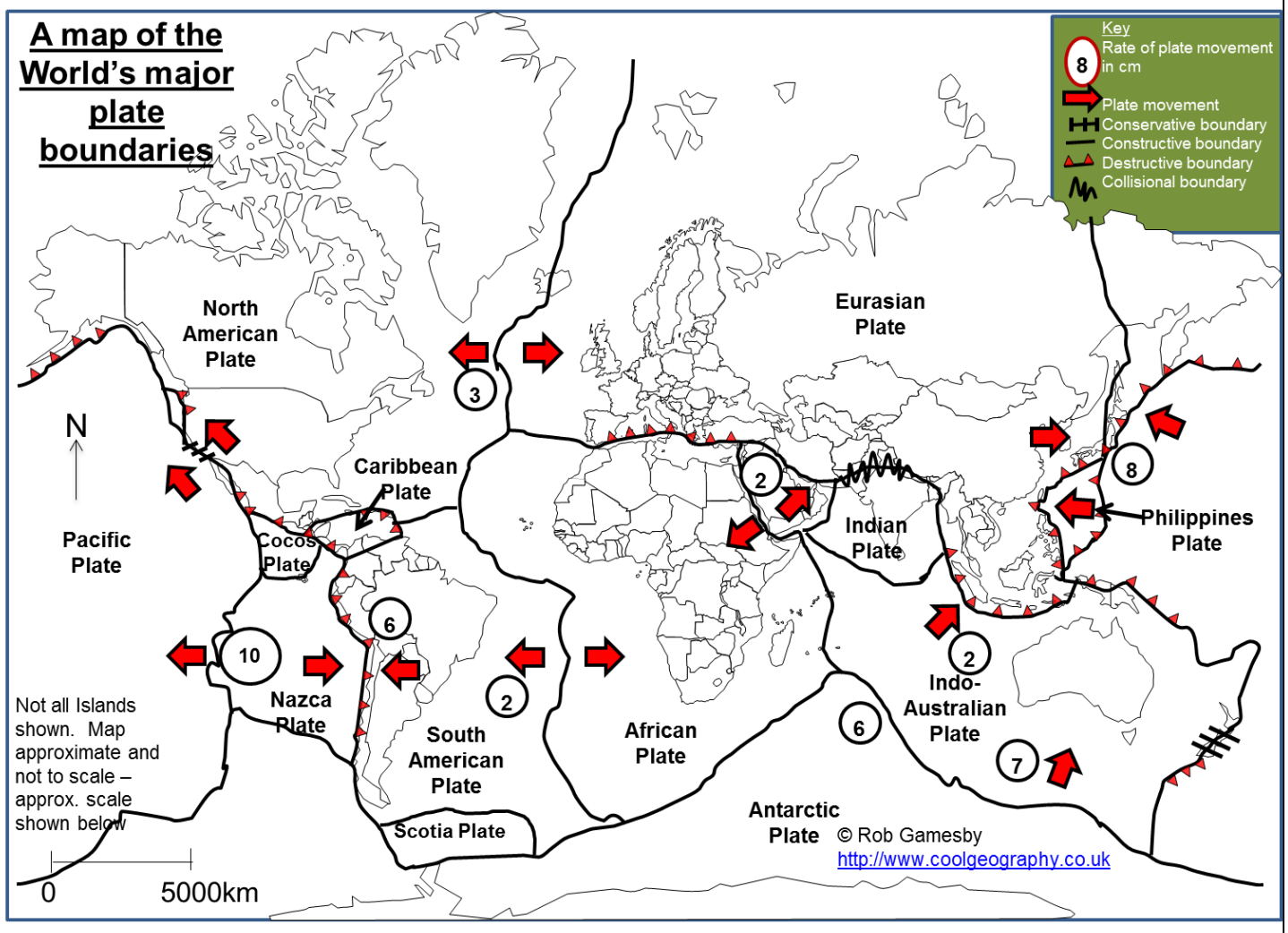
Layers of the earth



The crust is broken up into large slabs called tectonic plates. These plates float on the semi-molten rock of the mantle and are moved around by *convection currents.*

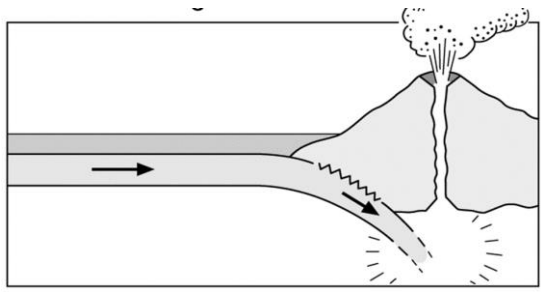
Continental plates: thick (30-50km) but light and old. Cannot be destroyed.
Oceanic plates: thinner (5-10km) but dense and younger.

Global distribution of earthquakes and volcanic eruptions and their relationship to plate margins. → see map

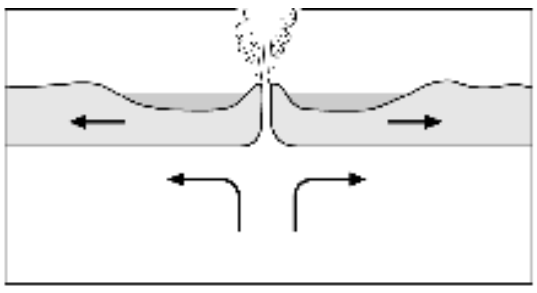


Physical processes taking place at different types of plate margin (constructive, destructive and conservative) that lead to tectonic hazards like earthquakes and volcanic activity. Tectonic hazard = A natural hazard caused by movement of tectonic plates (including volcanoes and earthquakes).

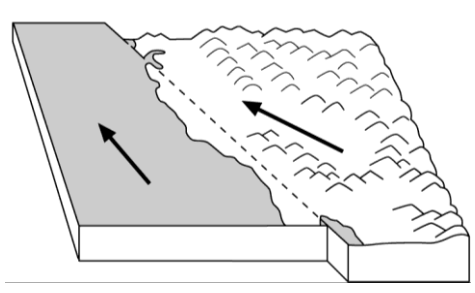
Destructive → ← Tectonic plate margin where two plates are converging or coming together and oceanic plate is subducted. (e.g. Nazca and South American plates) = earthquakes and volcanoes



Constructive ← → Tectonic plate margin where rising magma adds new material to plates that are diverging or moving apart. e.g. North American and Eurasian plate) = volcanoes

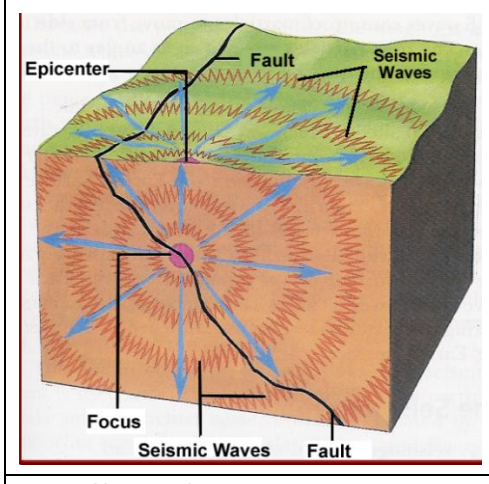


Conservative ↑↓ Tectonic plate margin where two tectonic plates slide past each other. e.g. Pacific and North American plate creating San Andreas fault) = earthquakes



Earthquakes occur at constructive, destructive and conservative plate margins.

An earthquake = a sudden or violent movement within the Earth's crust followed by a series of shocks.



Seismic waves = the vibrations of the crust's movement during an earthquake
Focus = the point in the earth's crust where seismic waves begin. Seismic waves are strongest and cause most damage nearest to the focus.
Epicentre = on the surface of the earth's crust directly above the focus on the earth's surface.

<u>Measuring earthquakes</u>

Richter scale measures magnitude (amount of energy released) of seismic waves on a logarithmic scale, 0-9+
Mercalli scale measures damage done by the earthquake 1 (very little damage) -12 (total destruction)

<u>Causes of earthquakes</u>

- Convection currents move plates together (at a destructive boundary) or alongside each other (at a conservative boundary).
- As the plates move past each other tension builds between them.
- Suddenly this pressure is released as seismic waves and the earth's crust vibrates. This is an earthquake.
- The seismic waves spread out from the focus.

- At a constructive plate boundaries, convection currents try to pull plates apart.
- Faults (cracks) in the rock are created and moved.
- Tension builds up in the plates with is suddenly released as seismic waves from the focus of the earthquake.

The effects of, and responses to, a tectonic hazard vary between areas of contrasting levels of wealth.

Primary effects: The initial impact of a natural event on people and property, caused directly by it, e.g. buildings collapsing following an earthquake.
Secondary effects: The after-effects that occur as indirect impacts of a natural event, sometimes on a longer timescale, e.g. fires due to ruptured gas mains resulting from the ground shaking.
Immediate responses: The reaction of people as the disaster happens and in the immediate aftermath e.g. evacuation, search and rescue
Long term responses: Later reactions that occur in the weeks, months and years after the event
e.g. rebuilding.

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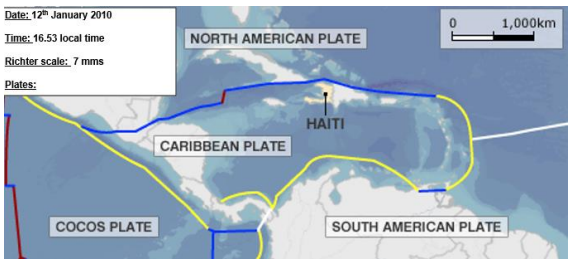
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<td>Use named examples to show how the effects and responses to a tectonic hazard vary between two areas of contrasting levels of wealth.
HIC: L’Aquila earthquake, Italy 6th April 2009, time 3.32 am, Richter scale 5.9, plates African & European
Primary effects
• 300 deaths
• 1500 people injured
• Tens of thousands of buildings were damaged or destroyed
• A bridge near the town of Fossa collapsed
• Water pipe broke near Paganica
Secondary effects
• 60,000 people were made homeless
• Insurance claims
• Homes destroyed by fires as gas pipes had been broken
• Broken water pipe cause a landslide
• Decline in tourism
• Transport disrupted following collapse of bridge at Fossa
• Businesses closed due to damage → drop in income.
• Electricity & phone services interrupted
Immediate responses
Evacuation, putting out fires, rescuing people, camps for homeless
Long term responses
Insurance claims, rebuilding, building of a new town to accommodate 20,000 people
LIC: Haiti earthquake, January 2010, 6.2 on Richter scale, near to Capital Port-au-Prince
Primary effects
• 230 000 deaths
• 300 000 injured
• slum housing collapses
• Factories like Palm Apparel Closed
• Half of schools in Port-au-Prince damaged
Secondary effects
• Cholera outbreak killing over 8000 people
• few hospitals open and emergency services overstretched
• loss of tourism
• 1.3 million homeless, 1 million still living in camps 1 year after the quake.
Immediate responses
Rescuing people, mass graves for dead, camps for homeless, international rescue organisations, lots of confusion and air traffic congestion, some violence and looting due to delays in aid distribution
Long term responses
$330million given by the EU, the World Bank waived debt repayments for 5 years, international aid organisations rebuilding, $1.1 billion collected by charities cash for work schemes, some refugees moved to the Dominican Republic</td>
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<td>Reasons why people continue to live in areas at risk from a tectonic hazard.</td>
<td>The advantages of living near volcanoes:
• Fertile soils e.g. around Vesuvius where much of Italy’s tomato crop is grown.
• Geothermal power is often a cheap and clean source of power – e.g. Iceland
• Usually, there are sufficient signs to move to safer places, so while property could be as risk injury is less likely e.g. Mount Pinatubo in the Philippines in 1991 was the 2nd largest eruption in the 20th century but only 300 died because of mass evacuation of the area.
• People have lived in the area for many years and are confident that there won’t be a severe eruption.
• Tourism is a strong pull, e.g. in Uganda, the volcanic region around Mt Elgon is being heavily promoted for its landscape, huge waterfalls, wildlife, climbing and hiking and its remote 'get away from it all' location.
The advantages of living in earthquake zones:
• Many earthquake areas are close to the coast – the climate is good, fishing and farming are easy.
• Many of these places like Japan get daily earthquakes and they have learnt to deal with them. They cause little or no damage as they adjust building methods for example.
• The big ones are very infrequent – 1906 and 1989 in San Francisco, so people believe they can manage</td>
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<td>Management can reduce the effects of a tectonic hazard.
How monitoring, prediction, protection and planning can reduce the risks from a tectonic hazard.

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<td>Monitoring: Recording physical changes, such as earthquake tremors around a volcano, to help forecast when and where a natural hazard might strike. [seismometers to detect tremors, tiltmetres to detect bulges in volcanoes, monitoring of sulphur dioxide levels]
Prediction: Attempts to forecast when and where a natural hazard will strike, based on current knowledge. This can be done to some extent for volcanic eruptions, but less reliably for earthquakes. Prediction then allows people to evacuate and move belongings.
Planning: Actions taken to enable communities to respond to, and recover from, natural disasters, through measures such as emergency evacuation plans, information management, communications and warning systems.
Protection: Actions taken before a hazard strikes to reduce its impact, such as educating people or improving building design [automatic shut off switches to gas and electricity supplies to prevent fires following earthquakes, rubber shock absorbers, interlocking bricks/steel frame, shatter proof windows to help buildings withstand earthquakes.]</td>
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