

Tectonic Hazards

Paper 1



Tectonic Plates:

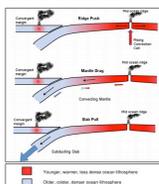
The Earth's crust (top layer) is not a solid shell. It is made up of thick, connecting pieces called tectonic plates.

- Oceanic Crust = 5-10km thick, new crust that is more dense
- Continental Crust = 25-100km thick, old crust that we live on

These plates move, there are two theories for this:

Slab Pull

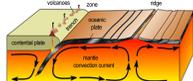
Gravity acts on heavy plates and pulls them apart. This forces one bit of the plate to rise and the oceanic crust bend downwards and slides into the mantle. This is known as subduction.



Convection Currents

A process that transfers heat energy.

- As the magma rises it heats the oceanic crust
- Crust cools and becomes denser and is forced underneath the less dense continental plate which causes subduction



Volcanic Eruption: Mount Merapi-

Mount Merapi is a stratovolcano located in Java one of the most densely populated areas in Indonesia.

Plate boundary - Destructive plate boundary - Indo-Australian subducted beneath Eurasian.

Monitoring - Merapi Volcano Observatory in Yogyakarta City where the level of volcanic alert is adjusted on a daily basis.

Date of eruption: October 2010

Magnitude - VEI 4

Impacts:

- Lahars
- Gases, up to 800°C
- Pyroclastic flows, at speeds of up to 100 km/h

Social: 353 deaths 200,000 homeless	Economic: \$700 million financial loss Increase in prices of food	Environmental: 26,000ha crops in ash 27 million m ² of ash deposited in River Gendol
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Responses:

- Short:**
- 320,000 evacuated from a 10km radius
 - 700 emergency shelters
 - Australia donated \$1million
- Long:**
- grants for farmers to replace livestock
 - Arkomiogia (NGO) started a micro-credit scheme to create sustainable hazard proof homes

Small features: Ash Clouds

- explosive eruption throws a mixture of gas, rock and tiny lava pieces high into the air

- Long term health affects
- Volcanic winters
- Makes soil more fertile

EG: Eyjafjallajökull (2010)



Pyroclastic Flow - hot ash, gas and rock that travel fast downside of volcano

- Deadly
- Habitats destroyed

EG: Montserrat (1997)



Lahar - landslide or mudflow, volcanic debris, mud, rock and water. Long term health affects

- Bury or destroy houses
- Fertilisers soil

EG: Mount Pinatubo (2010)



Lava flow - slow moving molten rock Bury or destroy houses

- Burns habitats and buildings
- Geothermal energy

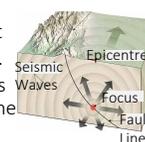
EG: Kilauea, Hawaii



Earthquake:

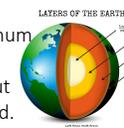
Caused by friction at tectonic boundaries.

Can lead to tsunamis when occur under the sea water.



Structure of Earth:

- Crust = thin (maximum 100 km thick)
- Mantle = s solid, but can flow like a liquid.
- Outer core = liquid iron and nickel
- Inner core = 5,500°C.



Tsunami: Japan

Plate boundary - Destructive plate boundary - The Pacific Plate, subducts under Eurasian Plate

Monitoring - Pacific Tsunami Warning System (PTWS) uses seismographs and ocean buoys to detect earthquakes

Date of tsunami: 11th March 2011

Magnitude - 9M_w

Impacts:

- Social:**
- 20,000 deaths
 - 500,000 homeless



- Economic:**
- \$300 billion



- Environmental:**
- Fukushima nuclear meltdown released harmful radiation impacting local habitats



Responses:

36 Nuclear reactors shut down causing blackouts

Earthquake: Nepal

Plate boundary - Destructive plate boundary - Indian plate subducting beneath Eurasian.

Date: 25th April 2015

Magnitude - 7.3M_w

Impacts:

- 400 aftershocks

Social: 9000 deaths 450,000 homeless	Economic: \$5 billion economic cost Increase in prices of food as no delivery	Environmental: Kathmandu is now 3m further south Avalanches destroyed habitats
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Responses:

- Short:**
- 300,000 people from Kathmandu to migrated seek shelter
 - 500,000 emergency shelters
- Long:**
- \$5 million donated in aid
 - fresh food and water still supplied to those in need

Why are some places more vulnerable than others?

- Size of vulnerable population
- Population density
- Level of development
- Education
- Early Warning Systems
- Governance
- Communication lines
- Magnitude of volcanic activity
- Quantity of well-trained professionals

Capacity = someone's ability to survive a hazard or recover from it quickly.

Hotspot - Magma plumes that create volcanoes on the surface (eg Mount Kilauea in Hawaii).

Types of volcano:

Shield: Magma with low viscosity and low gas content spreads out across a wide flat field.



Stratovolcano: Steep sided. Made of layers of ash and lava from a number of eruptions.

Cinder cone: smallest volcano made from lava ejected from a single vent



Tsunami: Solomon Islands

Plate boundary - Destructive plate boundary - Pacific and Indo-Australian Plates

Monitoring - Pacific Tsunami Warning System (PTWS) uses seismographs and ocean buoys to detect earthquakes

Date of tsunami: 1st April 2017

Magnitude - 8.1M_w

Impacts:

Social: 52 deaths 1,000 homeless	Economic: \$100 million	Environmental: Flooded 50-70m
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Responses:

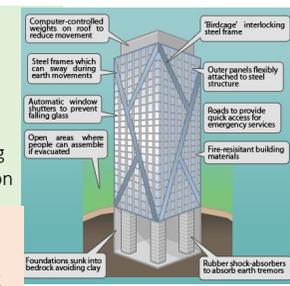
\$54.1 million sent by Australia as in the Solomon Islands they are a Small Island Developing State (SIDS) where 45% of population live in poverty

Largescale features formed by tectonic processes

Plate Boundary	Name of feature:	How is it formed?	Example:
Destructive	Ocean Trench	Subduction takes place	Mariana Trench, Western Pacific
	Fold Mountains	Continental crust is crushed and folded upwards	Andes, South America
Constructive	Ocean Ridge	As lava cools, a ridge is formed under the sea	Mid-Atlantic Ridge
	Rift Valley	Where two continental plates pull apart	Thingvellir, Iceland

Reducing the risk of tectonic hazards:

- Predicting:**
- Seismometer** - measure earthquakes
 - Geomagnetic** - measure the strength of magnetic fields in the rocks
 - Tiltmeter** - used to analyse ground movements
 - Geochemical** - monitor gas emissions
- Preparing:**
- Aseismic buildings
 - Hazard mapping
 - Educating population
- Plan:**
- Avoid building in places of risk



TEST YOURSELF

- Name two landforms found at a destructive plate boundary (2 marks)
- Explain why rocks get older the further away from an ocean ridge you travel (3 marks)
- Describe how tectonic processes at a destructive boundary have resulted in the formation of any large-scale feature (4 marks)
- Suggest why the time and date of when an earthquake strikes is important (3 marks)
- Explain why people who live in LIC's are likely to be more vulnerable to the impact of tectonic hazards (6 marks)
- Explain two features of an earthquake proof building (4 marks)
- Compare a volcano found at a constructive plate boundary to a destructive plate boundary (6 marks)
- Describe the process that takes place at a destructive plate margin where an oceanic plate meets a continental plate (4 marks)