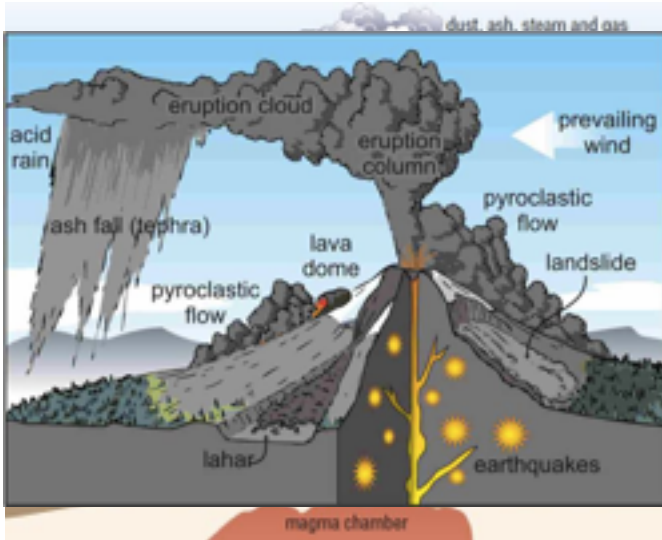


# Cracks and Cones - Geography Revision Notes

## Composite volcanoes

- Made up of alternating layers of lava and ash and containing sticky lava which doesn't flow very far (e.g. Mt. Etna in Italy)
- Usually found at destructive plate boundaries
- Steep-sided and cone-shaped

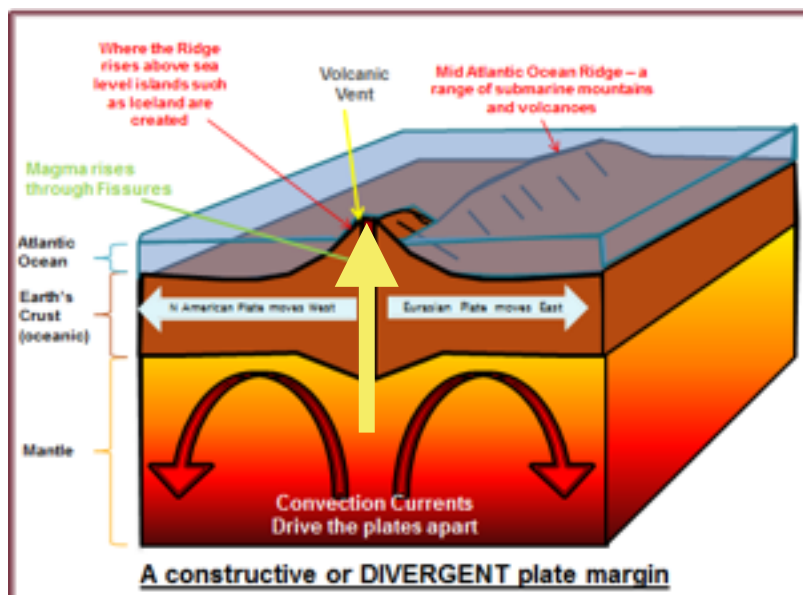


Molten lava eventually cools to form new rocks. After more eruptions over time, the amount of rock builds up forming a cone-shaped volcano.

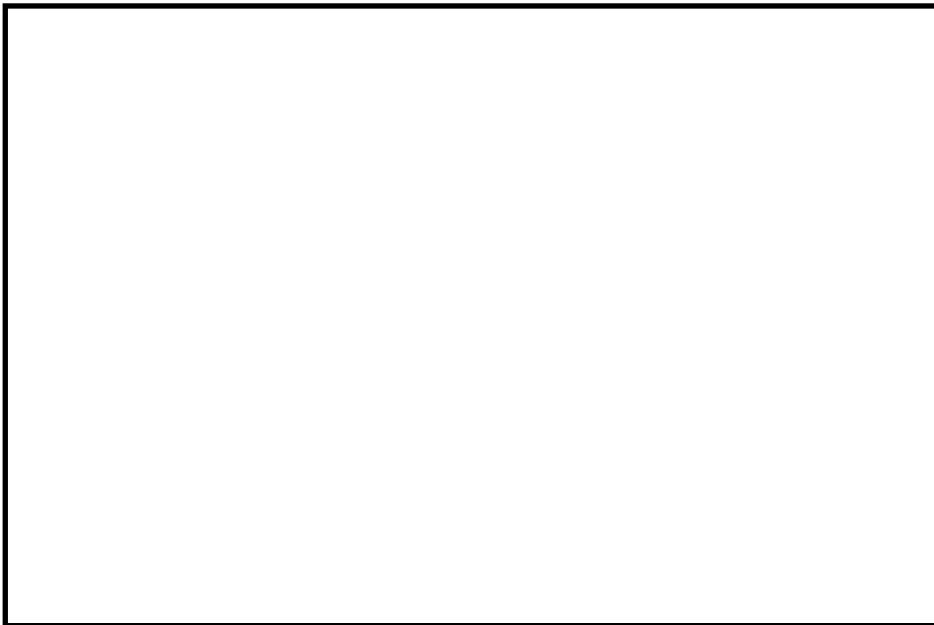
## Different Types of Plate Boundaries

### Constructive Plate Boundaries/Divergent Plate Margin

Divergent plate margin occurs when two **continental plates** move apart. As these plates move apart, it leaves cracks and fissures, lines of weakness, allowing magma to rise up from below the earth's crust. Pressure builds up which then releases suddenly causing the magma to erupt onto the surface and cools as new land. Both earthquakes and volcanoes can result at these plate boundaries, the earthquakes are caused by the movement of magma through the crust. When this happens on land, a rift valley is formed.



E.g. Mid-Atlantic Ridge, East African Rift valley in Kenya

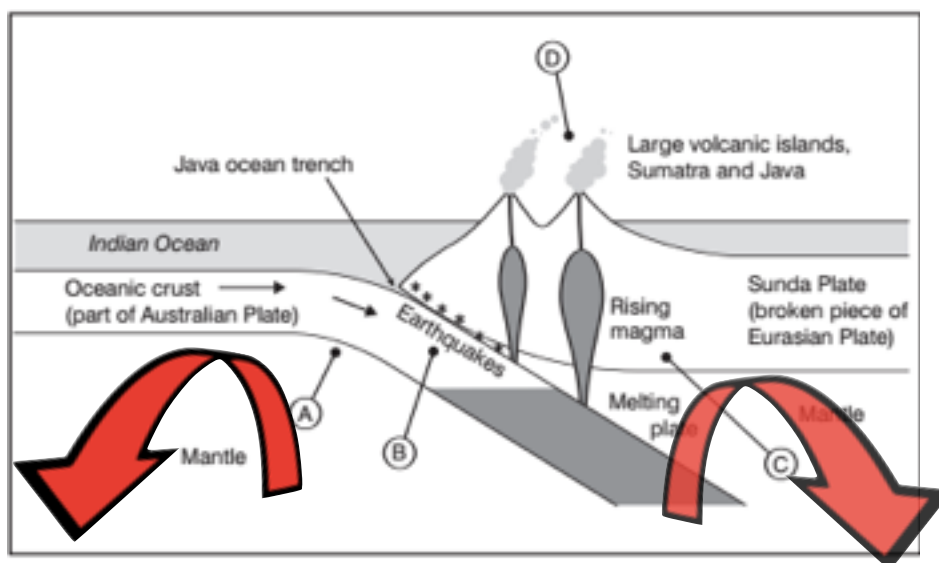


Oceanic plate uplifted and torn apart to produce a mid-oceanic ridge. New crust is generated between the diverging plates.

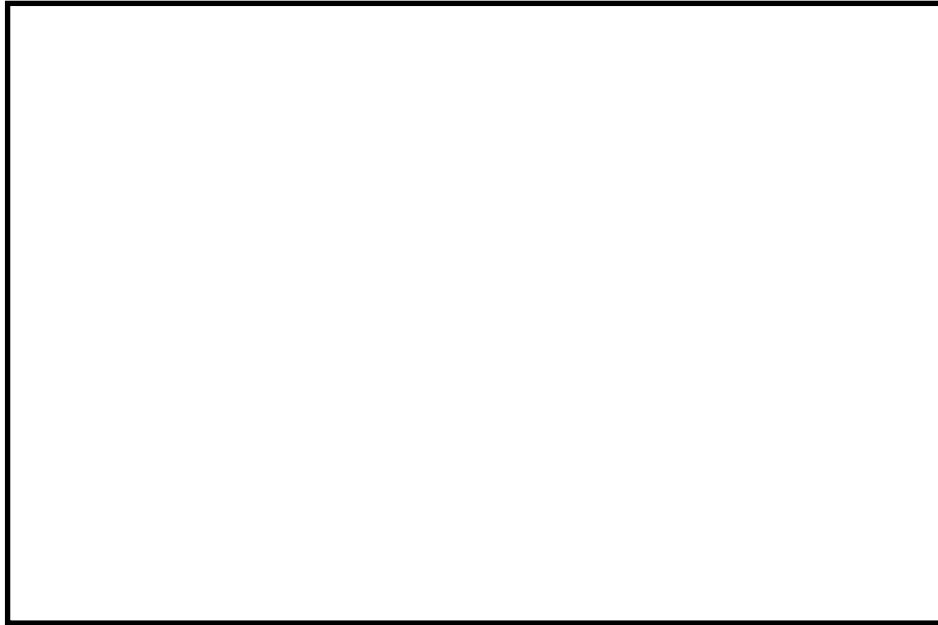
#### Destructive/Subduction Plate Boundaries

Two plates move or **converge** together and the **oceanic plate** (the denser plate) gets pushed under a **continental plate** (less dense) by **convection currents** deep within the Earth. The oceanic plate is **subducted** under the continental plate at a subduction zone, creating a deep **ocean trench**. The Oceanic crust **sinks** down into the mantle and as it descends friction, increasing **pressure and heat** from the mantle **melt** the plate. Some of the molten material work its way up through the continental crust through cracks in the crust. This is often some distance away from the margin where magma can eventually **re-emerge at the surface** to create a range of mountains. The movement of the plates grinding past one another can create earthquakes, when one plate eventually slips past the other releasing seismic energy. **one oceanic plate(denser, get subducted under), one continental plate**

E.g. Merapi (Java Indonesia), West coast of America, Philippines plate got pushed under



the Eurasian plate



### Collision

At these margins 2 plates of similar density are forced toward each other. The 2 plates crumple into one another and fold upwards into fold mountains. At these margins we get fold mountains (two **continental plates** collide) and **earthquake** activity, and a fantastic example of this is the **Himalayan mountains**. Here, the Indo-Australian plate is colliding with the Eurasian plate and has done so for millions of years.

### Conservative Plate Margins

Volcanic eruptions do not happen and crust is not destroyed. Two plates either side past each other in opposite directions, or two plates slide past each other at different speeds. As they move past each other, energy is built as the plates grind on one another. When the energy is released it sends shock waves(earthquake) through the earth's crust.

E.g. San Andreas fault in California (Pacific plate moving faster than North American plate)

**Earthquake no volcano, two continental plates**

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Recap:

#### Constructive margins:

- Constructive margins are formed by rising magma splitting up continental crust and forming new oceans
- The Eurasian Plate is separating slowly from the North American Plate. The mid-Atlantic ridge is a constructive margin sometimes visible above sea level, as in Iceland.

#### Conservative margins:

Where plates slide past each other or move in the same direction but at different speeds then:

- no crust is formed or destroyed, and volcanoes do not form
- great strain builds up along the junction, with sudden lurches along the **fault**
- **earthquakes are frequent and often large**

## E.g. San Andreas fault

### Destructive margins:

- Oceanic plates collide with continental plates
- Oceanic plate sinks beneath the continental plate
- Subduction creates a very deep ocean trench near the line of contact between the oceanic and continental plates
- Increased pressure and temperature
- long chains of volcanoes, known as volcanic arcs, are located above subducted plates (e.g. the Indonesian islands)

New crust is made at constructive margins and old crust destroyed at destructive margins. Oceanic crust is created and destroyed. Continental crust is folded, crushed and compressed, but not destroyed.

What is the Pacific Ring of Fire and why are so many volcanoes and deep ocean trenches found here?

It is along plate boundaries where one plate is subducted under the other or plates are sliding past each other. The pressure and increased friction cause the rock sediments to rise up to the surface forming ocean trenches, volcanoes and earthquakes.

How do convection currents work and what is the link between convection currents and volcanoes?

definition: high temperatures in the core caused by gradual radioactive decay create rising limbs of material in the mantle

These convection currents cool and spread out as they rise before sinking again - just like a lava lamp. Some of this rising and falling material moves in sheets, creating movements in the crust above it, which is pulled apart to form new crust. In other places it rises as columns, creating hotspots.

Heated rock in mantle rises as less dense; semi-molten rock spreads out, carrying the plate above with it; Magma cools and sinks back down to be reheated.

journey to the centre of the Earth: core, mantle, crust

What is a "hotspot"?

Hotspots are areas of rising plumes of magma in the asthenosphere which create volcanoes in the crust as it moves over them, leaving a long trail of island volcanoes. Crust is moving over a column of rising magma. (d.g. Hawaii)

The movement of tectonic plates is caused by the flow of magma beneath the earth's crust's surface. The movement may result in formation of valleys or eruptions of volcanoes.

## Different Hazards and their Causes (Volcano)

Depends on

- the size of the event
- the vulnerability of the population - poverty and high densities increase vulnerability
- the capacity of the population to cope - how prepared they are

		How it work	Examples
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Primary Hazards	Pyroclastic flow	<ul style="list-style-type: none"> <li>• dense, fast flowing grey cloud</li> <li>• 600~700°C</li> <li>• burns and inhalation of hot ash and gases</li> <li>• Travels at a speed greater than 80km/h</li> <li>• occur when the vent area or ash column collapses</li> </ul>	<p>Mayan Volcano, 1993</p> <ul style="list-style-type: none"> <li>• 75 people died</li> <li>• Pyroclastic flows can go across large bodies of water</li> </ul>
	Gas Emissions	<ul style="list-style-type: none"> <li>• Gases released from geosphere into atmosphere</li> <li>• irritate skin tissues</li> <li>• cause loss of function</li> <li>• CO<sub>2</sub>, S, CL</li> </ul>	<ul style="list-style-type: none"> <li>• Lake Nyos, Cameroon</li> <li>• Gases were released from beneath the lake's surface</li> </ul>
	Lava bomb	<ul style="list-style-type: none"> <li>• bigger than 6.4cm in diameter</li> <li>• Destruct buildings</li> </ul>	Columbia, Galeras, 1993
	lateral blast	<ul style="list-style-type: none"> <li>• Happens on the flanks/ side of a volcano</li> <li>• horizontal energy blast</li> <li>• unexpected</li> </ul>	Mt. St. Helens, 1980 within 31km radius areas were affected
	Ash	<ul style="list-style-type: none"> <li>• fragments of pulverized rock, minerals and volcanic glass</li> <li>• disruption to electric power</li> <li>• cut off rain water supplies</li> <li>• plane engine</li> <li>• breathing difficulty</li> </ul>	Vesuvius Naples, Italy
Secondary Hazards	Lahar = ash and water	<ul style="list-style-type: none"> <li>• fast moving slurries of rock, mud and water; flowing wet concrete</li> <li>• can travel at up to 100km/h</li> <li>• destroys everything within its path</li> </ul>	Armero, Columbia volcano 30 miles away 13 feet high
	Tsunami	<ul style="list-style-type: none"> <li>• Ash and debris from volcano mix with water</li> <li>• cause loss of life as they are hard to detect early</li> <li>• destroy homes</li> </ul>	Krakatoa, Indonesia, 1889 40 meters tall
	Landslides	Heat from cooling magma can cause hydrothermal alteration of the rocks, turning sections of them into clay. This weakens the rocks and increases the risk of slope failures.	

	Flooding	Explosive eruptions can change the surface areas around a volcano and disrupt drainage patterns, leading to long-term flooding	
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Other secondary effects include:

- Food / water supply interrupted.
- Homelessness.
- Businesses forced to close.
- Cost of insurance claims.
- Unemployment.
- Long-term issues with the tourism industry.

Impact of earthquakes:

Primary impacts - the immediate effect of an earthquake on property and people. For earthquakes this is the people killed as a result of the shaking and property destruction.  
 Secondary impacts - the impact on property and people of an event after it has finished. Lack of shelter and basic supplies, as well as fires, are frequent secondary effects.

Positive	Negative
The dramatic scenery created by volcanic eruptions attracts tourists. This brings income to an area.	Many lives can be lost as a result of a volcanic eruption.
The lava and ash deposited during an eruption breaks down to provide valuable nutrients for the soil. This creates very fertile soil which is good for agriculture	If the ash and mud from a volcanic eruption mix with rain water or melting snow, fast moving mudflows are created. These flows are called <i>lahars</i> .
The high level of heat and activity inside the Earth, close to a volcano, can provide opportunities for generating geothermal energy.	Lava flows and lahars can destroy settlements and clear areas of woodland or agriculture.
	Human and natural landscapes can be destroyed and changed forever.

**Living with volcanoes**

Volcanoes kill far more people with gas emissions and ash than they do with lava.

Agricultural Benefits	Volcanic rocks are very rich in potassium and phosphorous making the soil very fertile especially in tropical area where there is more water. The amount of crops can feed on large populations.
Geothermal Energy	Steam from water heated by hot rocks below the surface of earth to generate electricity. It is very cheap and sustainable since it is a renewable source and no air pollution. 70% of the homes in Iceland are heated by geothermal energy.
Tourism	Volcanic landscapes often have very beautiful scenery. They attract a whole range of visitors. Tourists come to watch eruptions, see geysers, relax in hot springs or have mud bath. It also provide many jobs and these encourage people to live in the area. E.g. New Zealand North island, Pompeii in US
	Lava flows come down and make a natural harbors. When volcano is extinct, it could be built as a defensive wall using the rock and other debris material. e.g. Mount Fuji
Social Benefit	Hot springs are healthy for bathing e.g. In Japan nice for communities to share hot baths - run by communities
Scientific Study	Volcanologists explore volcanoes to get better understanding of the structure and help predict future eruptions. E.g. Sakurijima, Japan
Industrial and Minerals	Industrial materials come from volcanic rocks. Gold, silver, copper, tin, kaolin, boric acid, pumice etc. found in the remains of extinct volcanoes. Lava can be used for construction. Heated groundwater concentrates traces of these minerals into rich veins which can then be mined.

### Why people still live in danger zones

- some people think that disasters only affect other people and will never harm them - they ignore the dangers and assume they will be OK (lack of awareness of risk)
- some people come from families who have lived in danger areas for many many years - long before they knew that they were hazard zones - and they don't want to break family ties by moving away (cultural links)
- some people think that scientists will be able to predict any seismic activity long enough in advance for the area to be evacuated - so they feel safe to live there
- some people simply may not be able to afford to move anywhere else (Poverty)
- some of the settlements in danger zones eg. Mexico City, San Francisco, Los Angeles, have grown into enormous megacities and there just isn't space to rebuild them elsewhere away from danger

### **Approaches to living in danger areas**

There are three main approaches - the fatalistic approach, the acceptance approach and the approach

- The fatalistic approach - If it happens, it happens - it's all part of living in this area
- The acceptance approach - hazards are a part of everyday life here are we have learned to live with them - the benefits of living here outweigh the disadvantages
- The adaptation approach - events can be predicted and warnings given - this makes it safe to live here

## Primary and secondary impacts of Mt. Merapi

Impacts of the 2010 eruption	Social	Economic
Primary impacts	<ul style="list-style-type: none"> <li>• 360,000 people evacuated from the area; some refused to go and others returned during the eruption</li> <li>• 275 were killed, mostly by scalding hot ash and gas in pyroclastic flows</li> <li>• 570 were injured</li> </ul>	<ul style="list-style-type: none"> <li>• Several villages were destroyed and damage to crops from ash fall was widespread</li> <li>• About 2000 farm animals were killed</li> <li>• Many flights in the area were cancelled due to the ash cloud</li> </ul>
Secondary impacts	<ul style="list-style-type: none"> <li>• An area 10km around the volcano was declared a danger zone and 2600 people were not able to return to it</li> <li>• Thousands spent weeks living in cramped emergency centers</li> </ul>	<ul style="list-style-type: none"> <li>• 1300 hectares of farmland were abandoned</li> <li>• Economic losses of \$600 million due to severely reduced farming and tourism income</li> </ul>
Secondary Hazards	If the ash and mud from a volcanic eruption mix with rain water or melting snow, fast moving mudflows are created. These flows are called lahars.	

- Gas emissions, earth tremors and ‘bulging’ of a volcano’s flanks can be measured and used to predict eruptions
- Tsunami warning sirens can be used to evacuate people from coast before tsunami waves strike.

Reducing the impact by mitigation such as hazard resistant buildings, disaster kits and land use planning. (Earthquake)

### Building designs:

- Ground foundations - steel reinforced concrete slab foundation
- Balanced distribution of walls
- Large number of walls
- Structural Integrity of House - not old structure/rotten or eaten by termites
- Cross-bracing(to prevent floors from collapsing), shear wall, shear core, most, base isolator(absorbs pressure from the earthquakes)

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