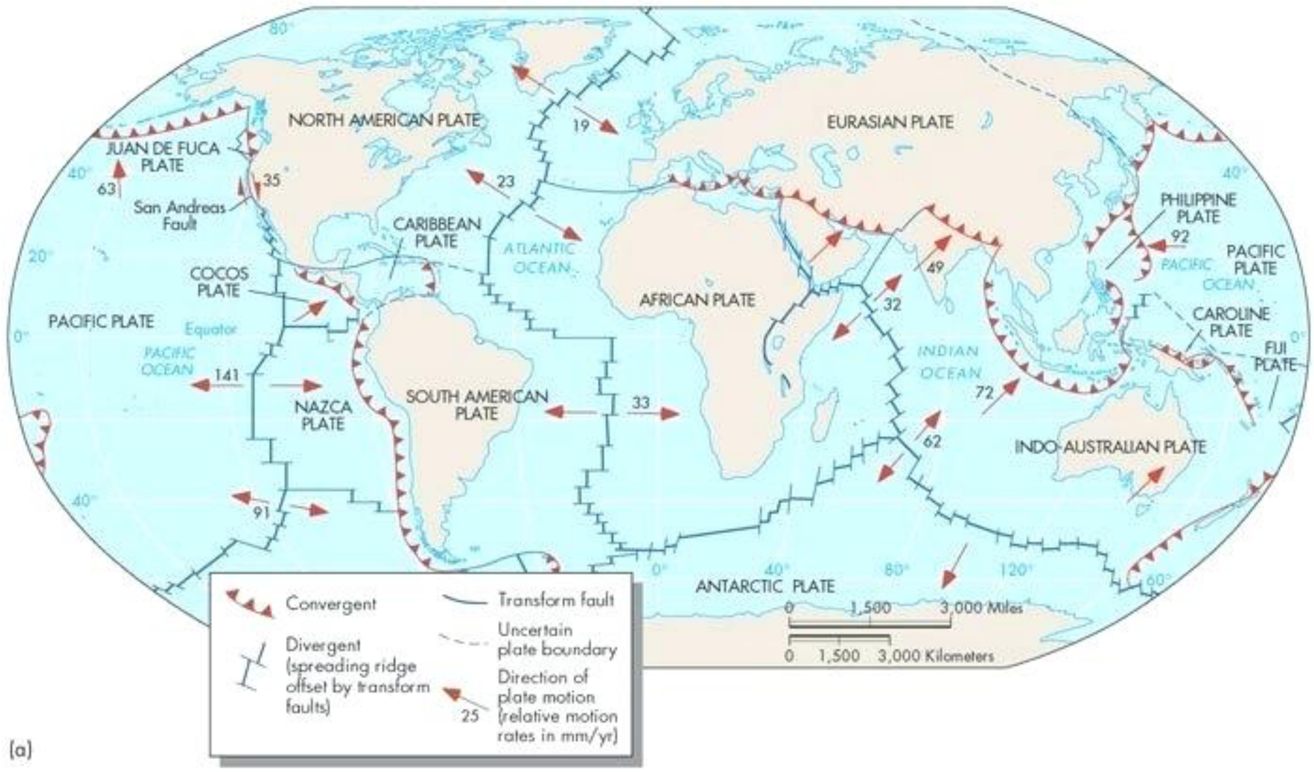
Name ________________________________

WJEC GCSE Geography

Unit 1 Optional Theme

Theme 3: Tectonic Landscapes and Hazards




Personal Learning Checklist for WJEC GCSE Geography

THEME 3 Tectonic Landscapes and Hazards KEY IDEA: 3.1 Tectonic processes and landforms 3.2 Vulnerability and hazard reduction	**Green**	**Amber**	**Red**
My knowledge domain I can…			
Give the meaning of each of the following: convection, subduction, divergence, capacity and vulnerability			
Describe large scale processes (convection, subduction and divergence) at constructive and destructive plate margins.			
Describe the global distribution of tectonic activity and its link to plate movement and boundaries.			
Give examples of volcano and earthquake hazards.			
Describe the features of distinctive volcanic landscapes including shield and strato volcanoes, cinder cones, lava tubes and geysers.			
Describe the characteristics and scale of pyroclastic flow, lava flow, lahar and ash cloud.			
My understanding domain I can…			
Explain why some volcanoes are found in the centre of plates e.g. Hawaii			
Use my understanding of tectonic processes to explain the differences between shield volcanoes, strato-volcanoes and caldera.			
Use my understanding of economic development to explain why some communities are more vulnerable to tectonic hazards.			
Explain how monitoring, hazard mapping, new building technology and improved emergency planning reduce the risks associated with earthquakes *and* volcanoes.			
Use my understanding of volcano and earthquake magnitude to explain why some tectonic events pose greater risks than others.			
My analysis domain I can…			
Study a photograph of a volcanic landscape that I haven't seen before and identify landforms at different scales.			
Use a variety of data to investigate factors that increase vulnerability to tectonic hazards.			
Select and use reliable evidence from tables, graphs or photographs to highlight impacts of earthquakes, tsunami and volcanic activity on health, infrastructure and economy.			
Compare the impacts of tectonic activity using evidence that has been presented to me.			
My evaluation domain **I can…**			
Weigh up the strengths and weaknesses of volcano monitoring/aseismic building technology/hazard/emergency planning			
Evaluate the physical, social and economic factors that can increase vulnerability to tectonic hazards.			
Discuss the vulnerability of communities in countries at different levels of economic development.			
My decision making domain **I can…**			
Make recommendations, using evidence, about how a named place can reduce the risks associated with tectonic hazards.			
Decide which risk reduction strategies are most appropriate for a given location. Justify my decision.			

Key Idea 3.1 Tectonic processes and landforms

Key Idea 3.1: Tectonic processes and landforms

Key questions	Depth of study
3.1.1 How do tectonic processes work together to create landform features at different scales?	An overview of the global distribution of tectonic activity and its link to plate movement and boundaries. Large scale processes (convection, subduction and divergence) at constructive and destructive margins. Resulting large scale features to include rift valleys and ocean trenches. The concept of volcanic hotspots (*for example Hawaii*). Processes which result in distinctive volcanic landscape features: **Larger scale features** to include shield volcanoes, stratovolcanoes, caldera. **Smaller scale features** to include cinder cones, lava tubes and geysers.

- Earth structure and plate movement
- Global distribution of tectonic activity
- Plate boundaries (processes of convection, subduction and divergence)
- Large scale features: Rift valleys, ocean trenches
- Volcanic hotspots

Processes resulting in distinctive volcanic landscapes:

- Larger scale features including shield volcanoes, stratovolcanoes, caldera
- Smaller scale features including cinder cones, lava tubes and geysers.

Keep this glossary up to date as we work through the theme 3.

Aseismic **Aseismig**	
Ash cloud **Cwmwl lludw**	
Caldera **Callor**	
Capacity **Gallu**	
Cinder cone **Côn lludw**	
Constructive (plate margin) **Adeiladol (ymyl plât)**	
Crust **Cramen**	
Destructive (plate margin) **Distrywiol/Dinistriol (ymyl plât)**	
Divergence zones **Cylchfaoedd dargyfeiriol**	
Fold mountains **Mynyddoedd plyg**	
Island arc **Arc o ynysoedd**	
Lahar **Lahar**	
Lava flows **Llifoedd lafa**	
Lava tube **Tiwb lafa**	
Magma **Magma**	
Moment magnitude scale (Mw) **Graddfa maint moment**	
Oceanic ridge **Cefnen gefnforol**	

Oceanic trench (Ffos gefnforol)	
Plate margin Ymyl plât	
Plates Platiau	
Pyroclastic flows Llifoedd pyroclastig	
Rift valley Dyffryn hollt	
Seismometers Seismomedrau	
Shield volcano Llosgfynydd tarian	
Slab pull Tyniad slab	
Stratovolcano Stratolosgfynydd	
Subduction zone Cylchfa dansugno	
Tsunami Tsunami	
Volcanic Explosivity Index (VEI) Indecs Ffrwydrolrwydd Folcanig	
Volcanic hotspot Man poeth folcanig	
Vulnerability Bregusrwydd	

Earthquake	Latitude	Longitude
California	40°N	-128°W
Alaska	59°N	-137°W
Romania	45°N	27°E
Iran	38°N	57°E
Chile	-33°S	-72°W
Aleutian Islands	54°N	171°E
Guatemala	15°N	-92°W
Aegean Sea	39°N	26°E
Pakistan	25°N	63°E
Fiji Islands	-23°S	-179°W
Philippines	6°N	125°E
Bolivia	-17°S	-63°W
Vanuatu	-15°S	167°E
Pyrenees	43°N	2°E
South Sandwich Islands	-56°S	-26°W

Volcano	Latitude	Longitude
Etna	38°N	15°E
Bogoslof	54°N	-168°W
Katla	64°N	-19°W
Lopevi	-17°S	168°E
Manam	-4°S	145°E
Erta Ale	14°N	41°E
Barren Island	12°N	94°E
Nyamuragira	-1°S	29°E
Poppcatépetl	19°N	-99°W
Poas	10°N	-84°W
Semeru	-8°S	113°E
Villarrica	-39°S	-72°W
Reventador	-1°S	-78°W
Shiveluch	57°N	161°E
Nishino-shima	27°N	141°E

Describe and explain the global distribution of volcanic eruptions and earthquakes.

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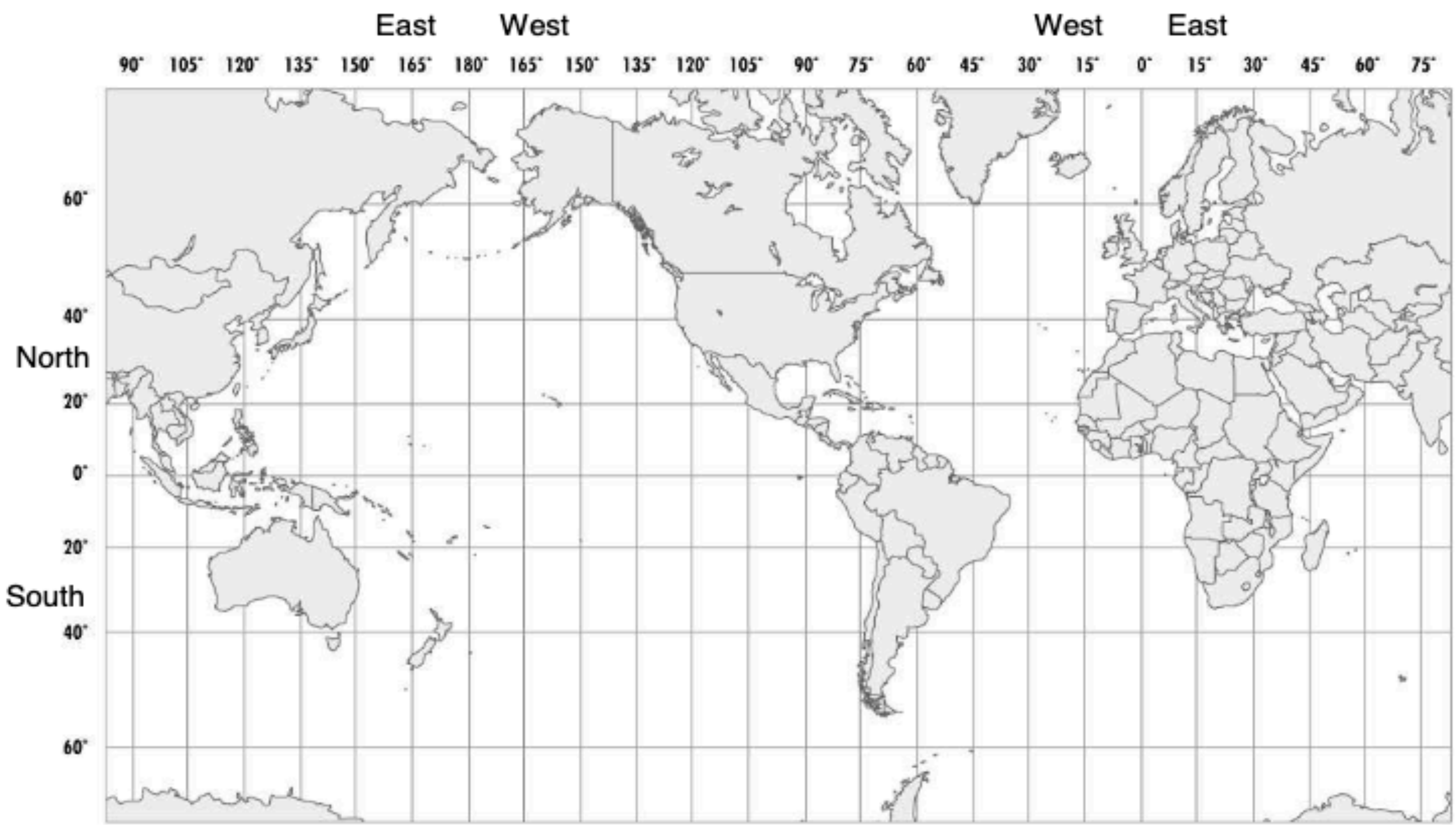
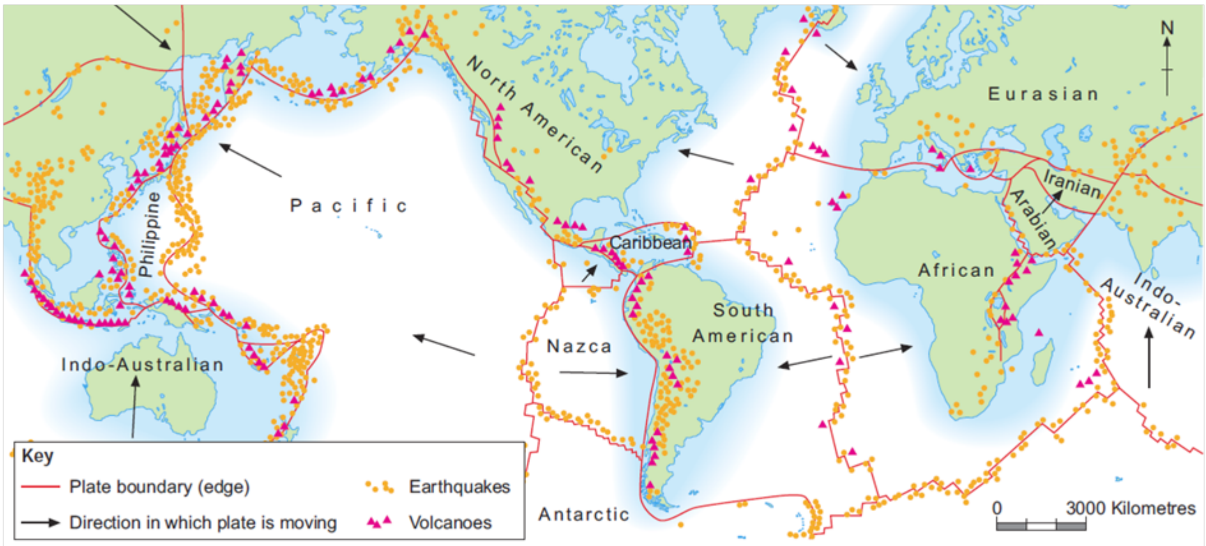

East
West
West
East
90° 105° 120° 135° 150° 165° 180° 165° 150° 135° 120° 105° 90° 75° 60° 45° 30° 15° 0° 15° 30° 45° 60° 75°
60°
40°
North
20°
0°
20°
South
40°
60°

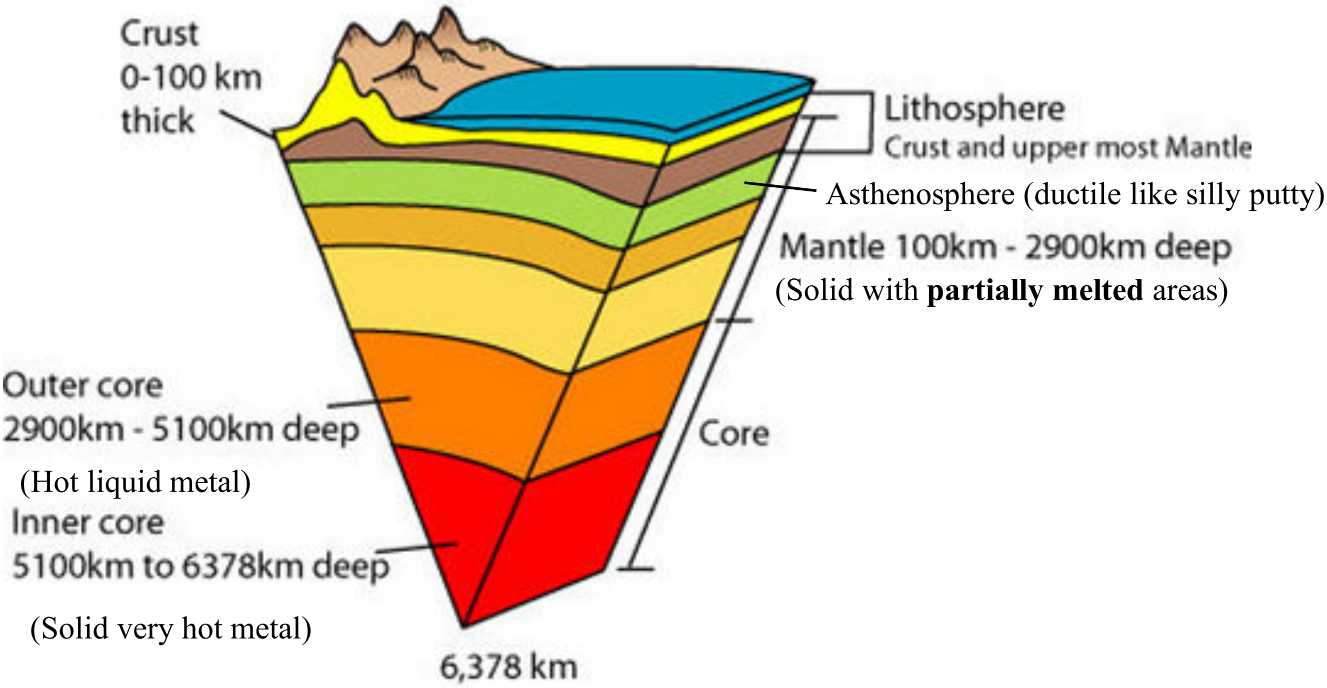
Introduction

Earthquakes and volcanoes are most likely to occur near plate margins:

- Where plates **converge**, a **destructive margin** is formed.
- Where plates **diverge** a **constructive margin** is formed.



The Earth has an internal structure which controls all of the processes involved in the generation of **active zones**. The structure of the Earth is illustrated below:



The lithosphere (crust and uppermost part of the mantle) is split into rigid **plates**. The plates move on the ductile upper mantle (asthenosphere). Where two plates move next to each other we have a **plate margin** or boundary.

Plate Movement

Heat from within the Earth causes molten rock, or **magma**, to rise up through the mantle. It is this rising magma that causes volcanic eruptions in places like Iceland in the Mid Atlantic. Magma rising through the **mantle** may also explain the movement of the plates that make up our crust. There are two theories: slab pull and convection.

Slab Pull

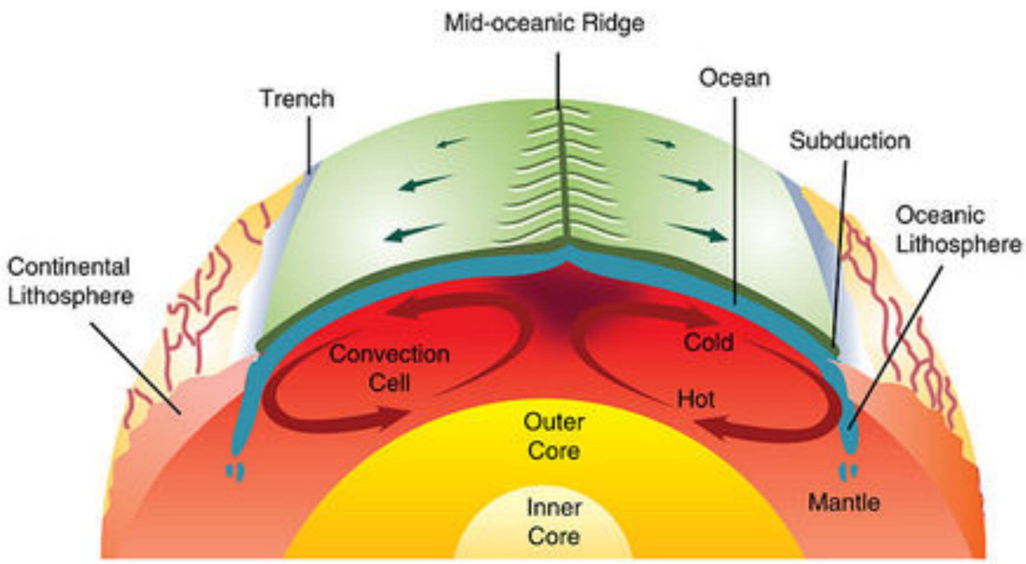
https://www.youtube.com/watch?v=kwfNGatxUJI
https://www.youtube.com/watch?v=9YPz9TQW4ZM

Slab pull is one explanation for plate movement. Plates are immensely heavy. In this theory, it is gravity, acting on these heavy plates, that pulls them apart. As magma rises beneath a constructive plate margin it heats the rocks of the crust and forces them to bend upwards. The crust is raised, forming the **mid-ocean ridge**, which is about 2,500m higher than the ocean floor. Gravity pulls the crust and it slides down the slope away from the centre of the mid-ocean ridge, allowing further eruptions. An even greater gravitational force pulls at the crust at the other end of the plate. This occurs where the oldest and densest ocean crust bends downwards and slides back into the mantle. This process is known as **subduction**. The huge mass of the subducting slab pulls the rest of the ocean plate away from the mid-ocean ridge.

Convection

https://www.youtube.com/watch?time_continue=33&v=p0dWF_3PYh4&feature=emb_logo

Convection is an alternative explanation for plate movement. It is a process that transfers heat energy. You can see it in boiling saucepan: the contents of the pan are heated by the hob beneath; the heat rises through the contents of the pan and you see bubbles burst at the surface, which is a little cooler; the cooler fluids sink back into the pan towards the heat source, and the whole process starts again. This creates a circular convection current. It is thought that a similar process may be happening in the mantle. The Earth's core is the heat source and magma rising through the mantle transfers this heat energy away from the source. If the convection currents exist within the mantle then they may help to explain the movement of the plates seen in the figure below.



1. A plume of hot magma rises through the mantle.
2. The oceanic crust is warmed and forced upwards by the magma, creating a mid-ocean ridge
3. The ocean crust cools, becomes denser and slides away from the ridge under gravity
4. A deep ocean trench is formed where the oceanic crust flexes downwards under the continental crust
5. The immense weight of the oceanic crust pulls the plate as it subducts into the mantle

1. Add the labels to suitable places on your diagram to describe the process of slab pull.
2. Add your own labels in a different colour to explain the process of convection.
3. Which of the two theories that explain plate motion do you think is the best explanation? Justify your choice.

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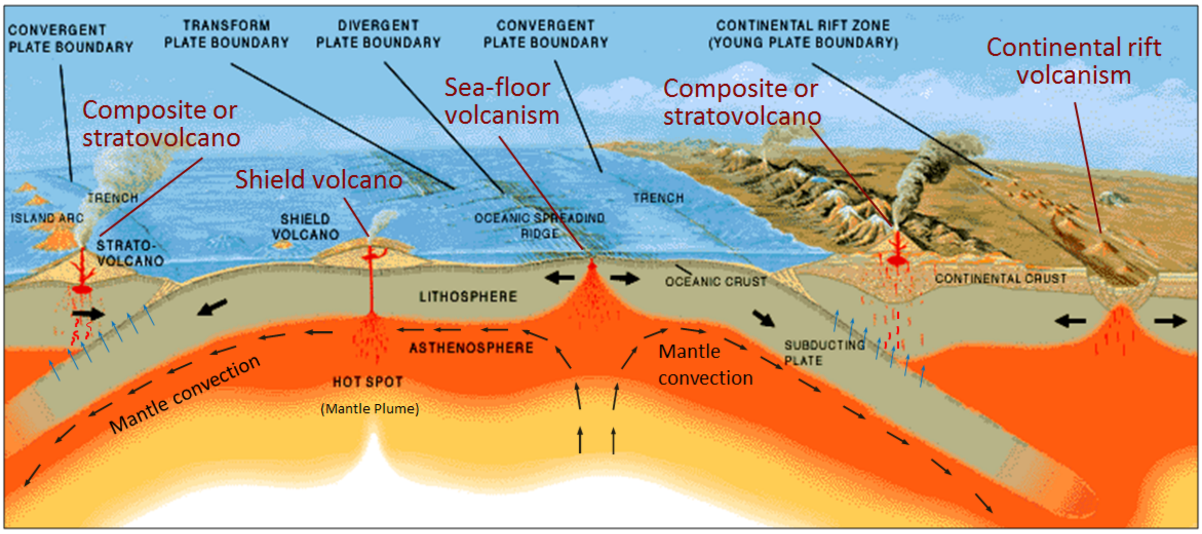
4. Why are explanations for plate movement described as theories?

5. Explain why an understanding of the asthenosphere is vital to our understanding of the theory of plate movement.

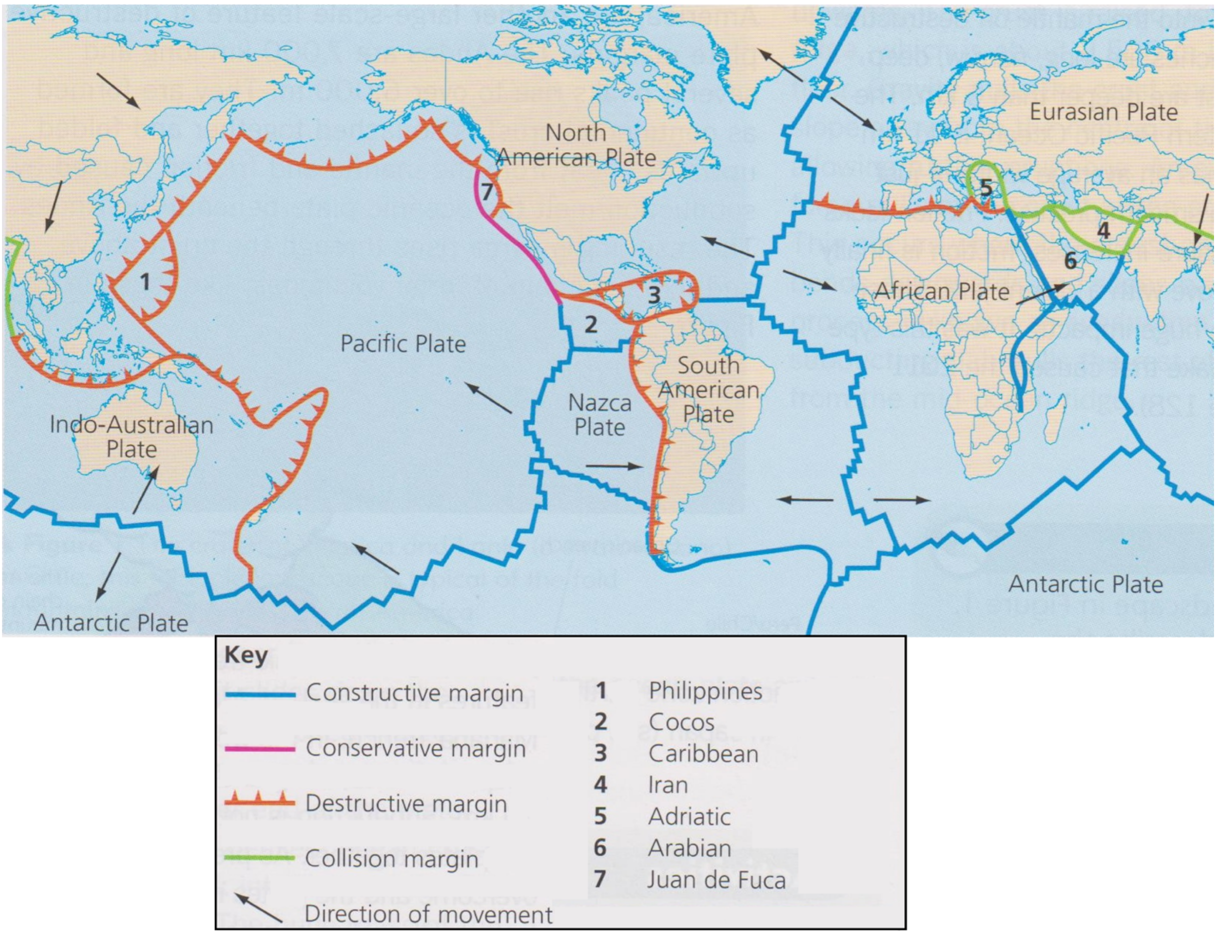
Large scale tectonic processes at constructive and destructive margins

Earthquakes and volcanoes are most likely to occur near plate margins.

Convection currents in the mantle move the tectonic plates.
Where convection currents **diverge** near the Earth's lithosphere plates move apart. Also known as a **constructive** margin.
Where the convection currents c**onverge** plates move towards each other. Also known as a **destructive** or **collision** margin.



Label 2 destructive and 2 constructive margins on the diagram above.



Use the map above to name pairs of plates that form:

a) Constructive plate margins

___________________________________ and ___________________________________

___________________________________ and ___________________________________

___________________________________ and ___________________________________

b) Destructive plate margins

___________________________________ and ___________________________________

___________________________________ and ___________________________________

___________________________________ and ___________________________________

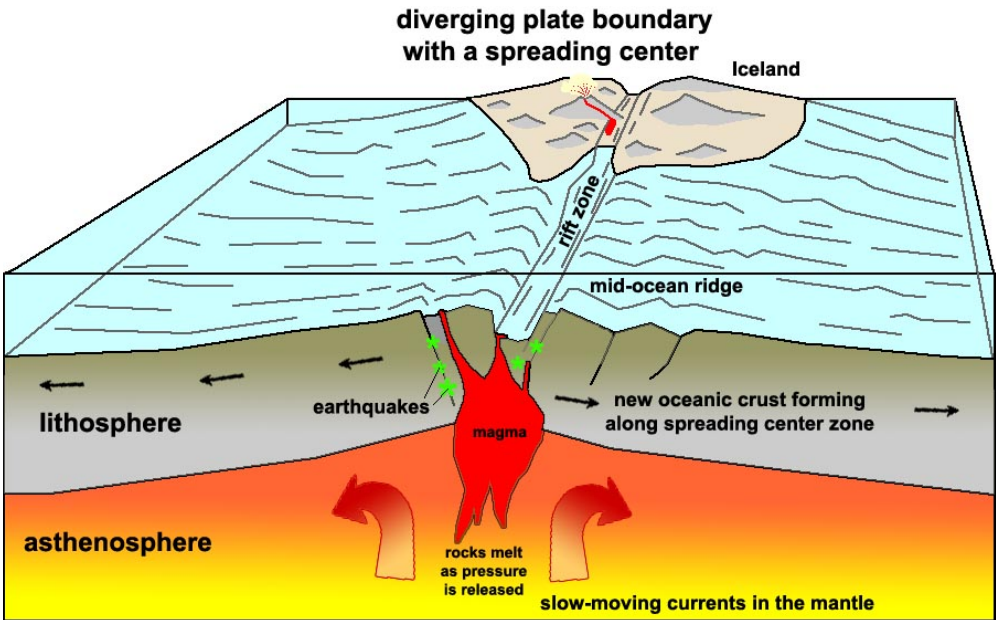
Name four countries that are on a destructive plate margin.

Name four countries that are on a constructive plate margin.

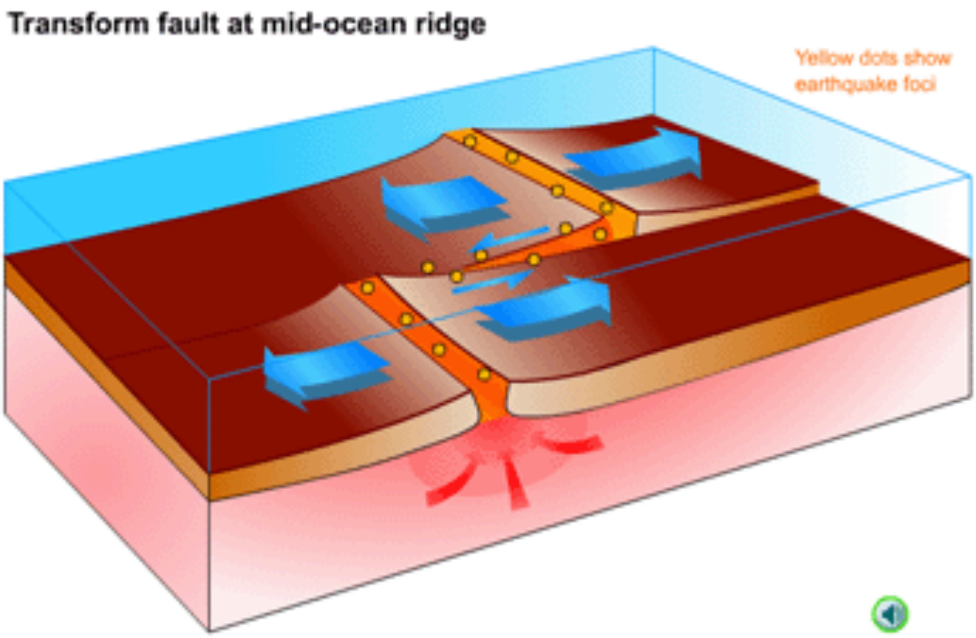
What large tectonic features are found at constructive plate margins?

These are margins where two plates are pulling apart (diverging). As this happens magma rises up between them and forms new crust as it cools on the edge of each plate.

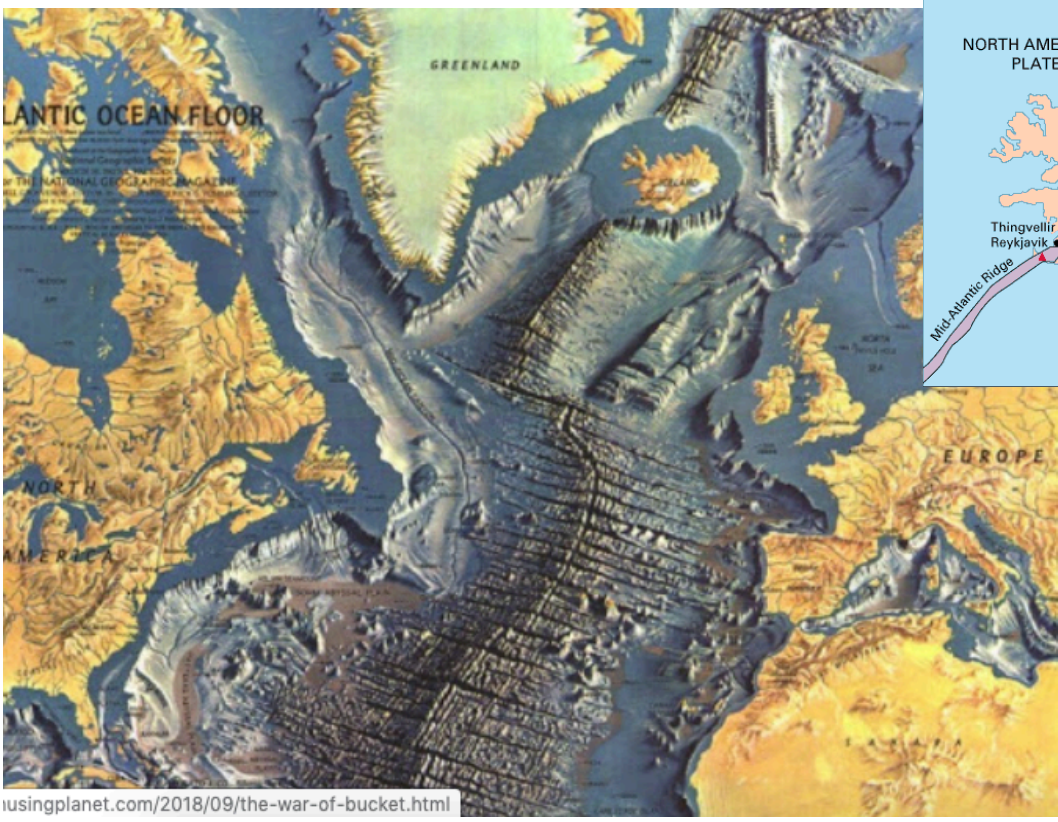
At the **mid-ocean ridge** this all happens deep under water. As a result, lava pours out from volcanoes and cools quickly. The crust rises to form a ridge of mountains at the margin of the plates, around 2,500m high and over 65,000km long.
The central region of the ridge is deeply cracked and fissured where the crust is pulling apart. Most of the ridge is around 2,500m below sea level but the ridge is visible in a few places where volcanic activity has created islands such as Iceland.

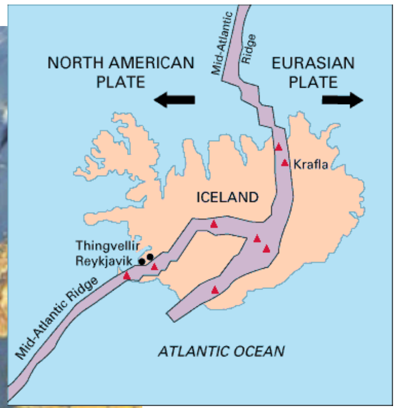


The margin is often fractured as the plates move at different speeds. Movement along these fractures (**transform faults**) can cause earthquakes as the large areas of solid rock grind against each other.

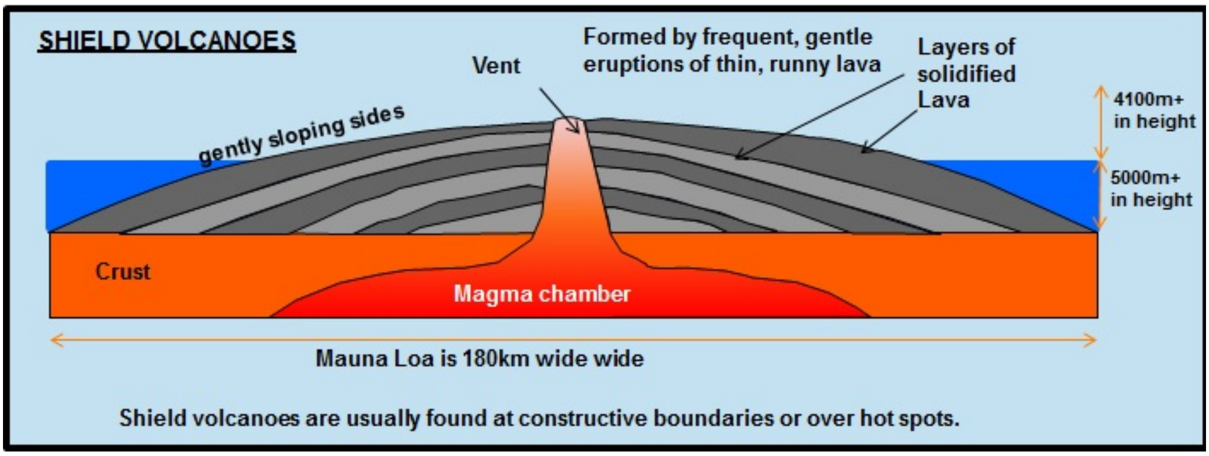


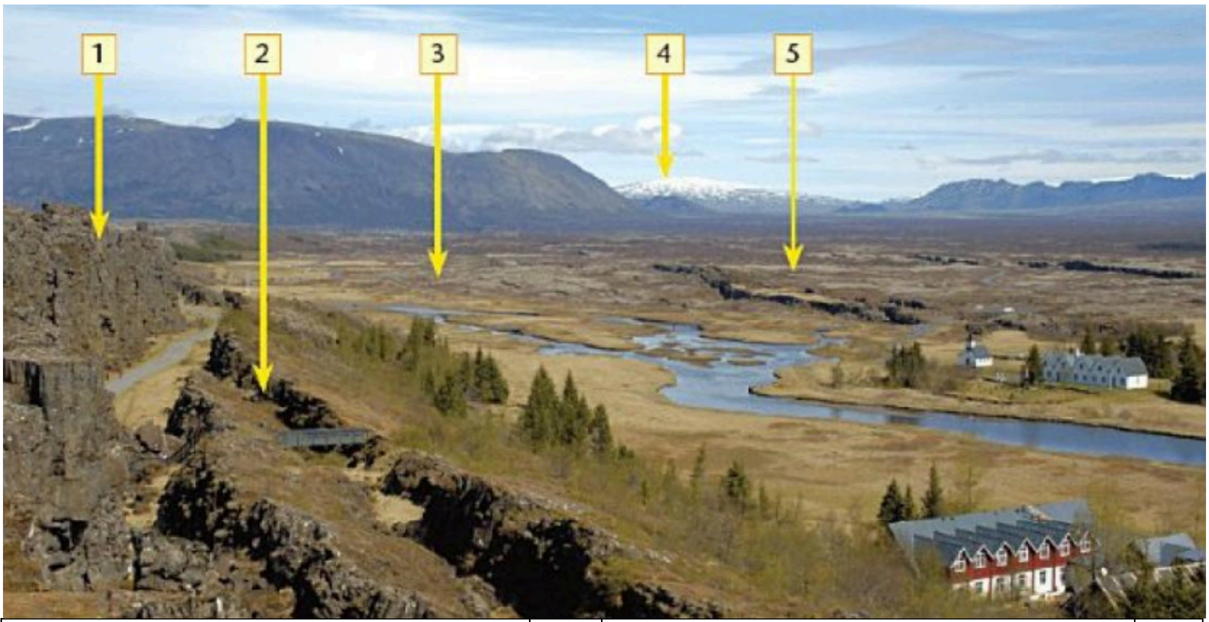
Iceland is the most striking example of a place where plates are moving apart on land. As the plates move apart the land splits and a **rift valley** is formed as the land collapses. This can generate both volcanoes and earthquakes. Iceland is gradually being torn apart and this can clearly be seen in Thingvellir National Park. Over time a giant fissure, 7.7km long, has opened in the earth's surface. As the fissure widened the land in the centre has gradually collapsed downwards. This process has formed the rift valley (or **graben**) with a flat valley floor and steep **escarpments** along either side. The rift continues to grow. The valley walls are pulling apart at a rate of about 7mm a year and the valley floor is subsiding at about 1mm a year.





Volcanoes at constructive boundaries tend to have very runny lava that flows easily from near to the surface. As a result volcanoes can be very large and wide. These are known as **shield volcanoes** due to their shape.





The rift valley floor is formed by subsidence		Deep fissures in the valley floor indicate further divergence	
Steep escarpments on the western edge of the rift		Tilted slabs of crust subside along the edge of the rift	
The gentle slopes of a shield volcano			

Explain why a rift valley or ocean ridge are formed where two plates diverge (move apart).
You must use a diagram to help your answer. [6]

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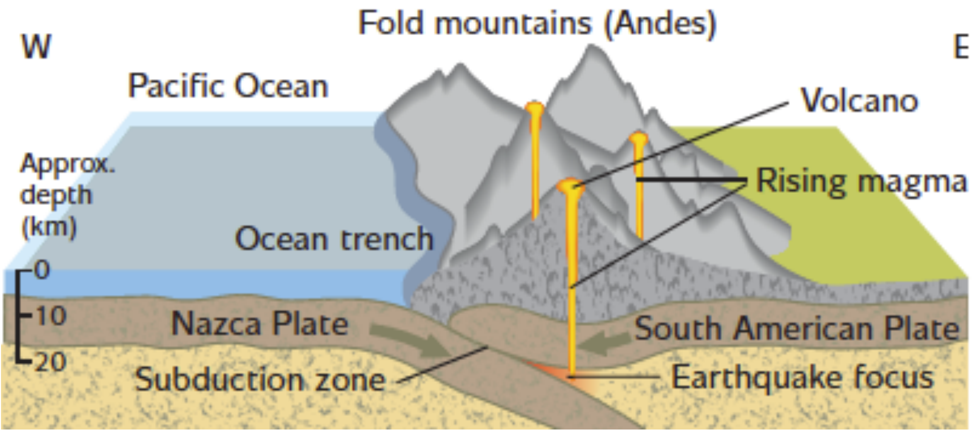
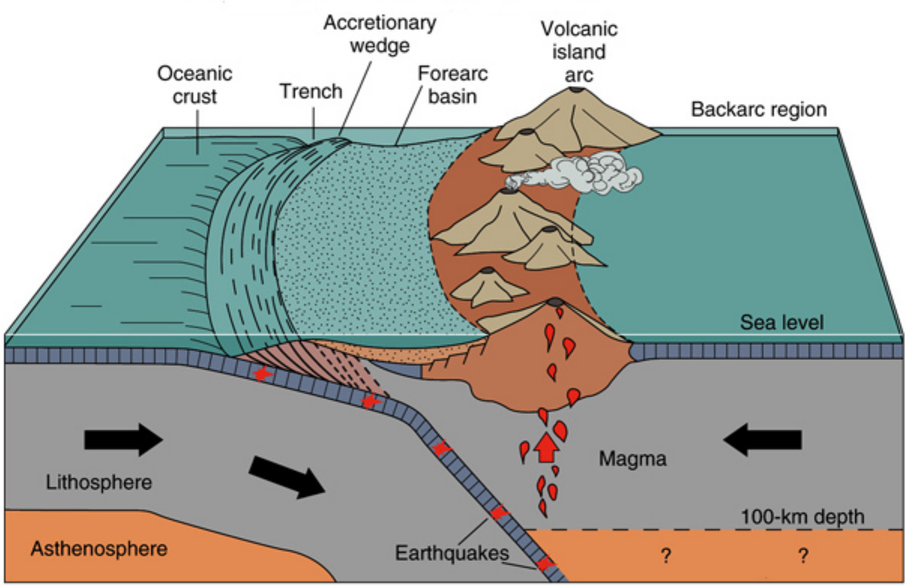
What large tectonic features are found at destructive plate margins?

At a destructive margin two plates are converging (moving together).
An example of this is the margin between the Nazca Plate and the South American Plate.



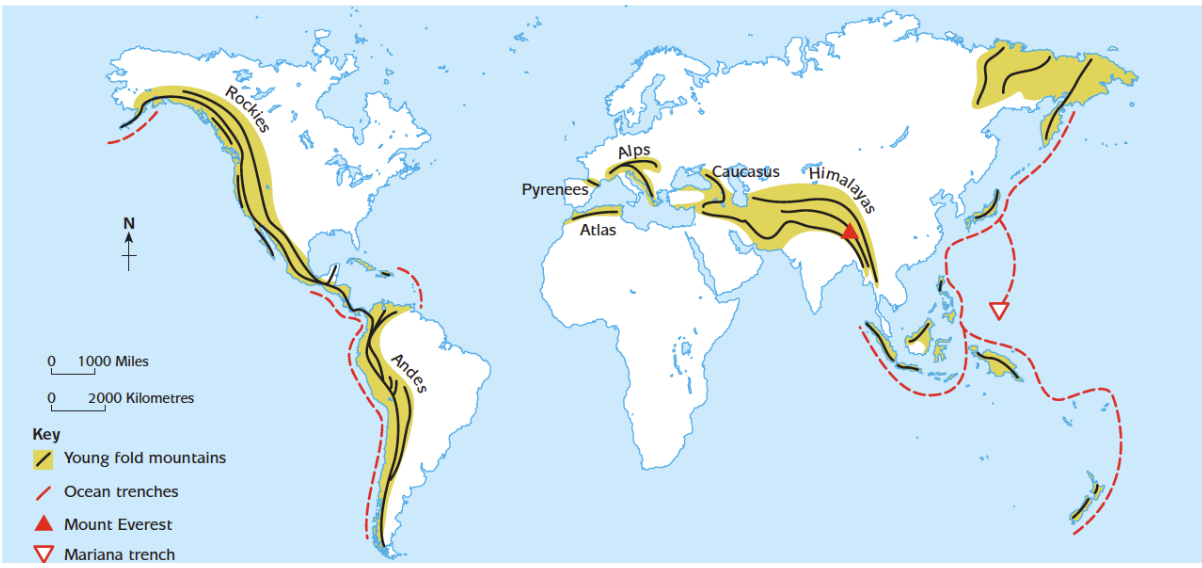
The Nazca plate is made of **oceanic** crust which is **denser** than the **continental** crust of the South American plate. The Nazca plate is forced to sink below the South American plate. The oceanic crust sinks into the mantle where it melts in the subduction zone. Energy builds up in the subduction zone – at certain times this may be released as an earthquake. The molten rock, called magma, may rise upwards, causing volcanic eruptions and leading to the creation of composite volcanoes. The lighter continental crust stays at the surface but sediment becomes crumpled into fold mountains.
The Andes are the fold mountains that have formed along the west coast of South America.

An island volcanic arc forms in an ocean basin via **ocean-ocean** subduction. The Mariana trench is located where the oceanic Pacific Plate subducts beneath the oceanic Philippine Plate.



Subduction is not a smooth process. Friction locks the plates together. As pressure increases, friction is finally overcome and the plates move with a violent jerk. These large earthquakes can have huge impacts. It was this type of subduction zone earthquake that caused the 2011 tsunami in Japan and the 2004 Boxing Day tsunami in SE Asia.

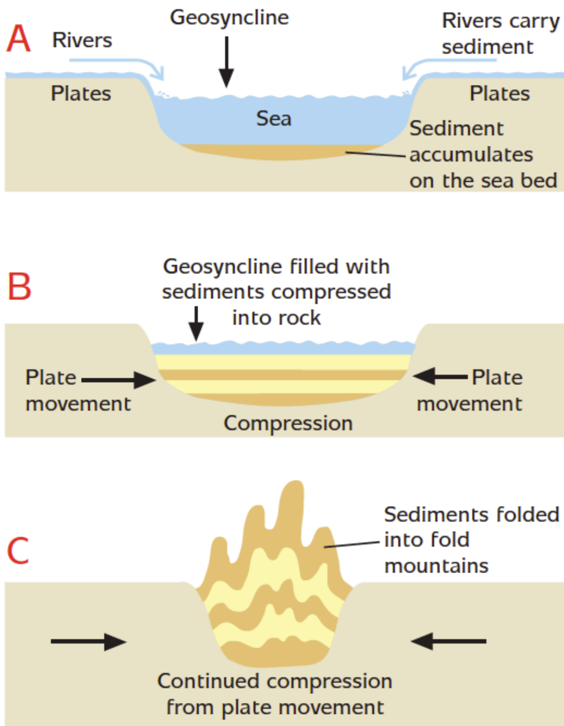
Highest mountain 8848m. Deepest ocean 11 022m. How can tectonic activity explain both?

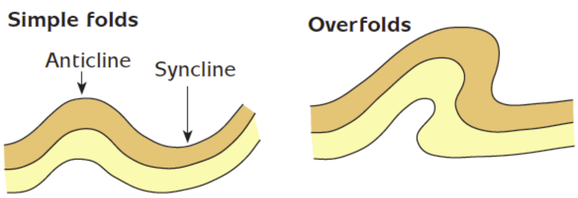


Fold mountains

Young fold mountains are found in many parts of the world and a glance back at your plate margin map shows that they form along the plate margins where great Earth movements have taken place.

This diagram shows the formation of fold mountains. There were long periods of quiet between Earth movements during which sedimentary rocks, thousands of metres thick, formed in huge depressions called geosynclines. Rivers carried sediments and deposited them into the depressions. Over millions of years the sediments were compressed into sedimentary rocks such as sandstone and limestone. These sedimentary rocks were then forced upwards into a series of folds by the movement of the tectonic plates converging. Sometimes the folds were simple and in some places the folds were pushed over on one side, giving overfolds.

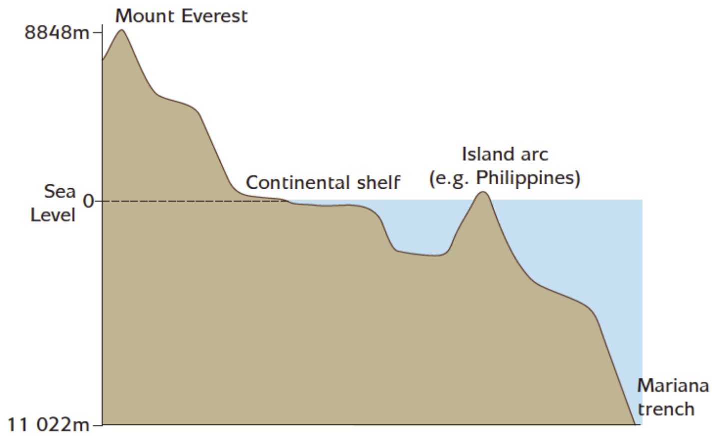


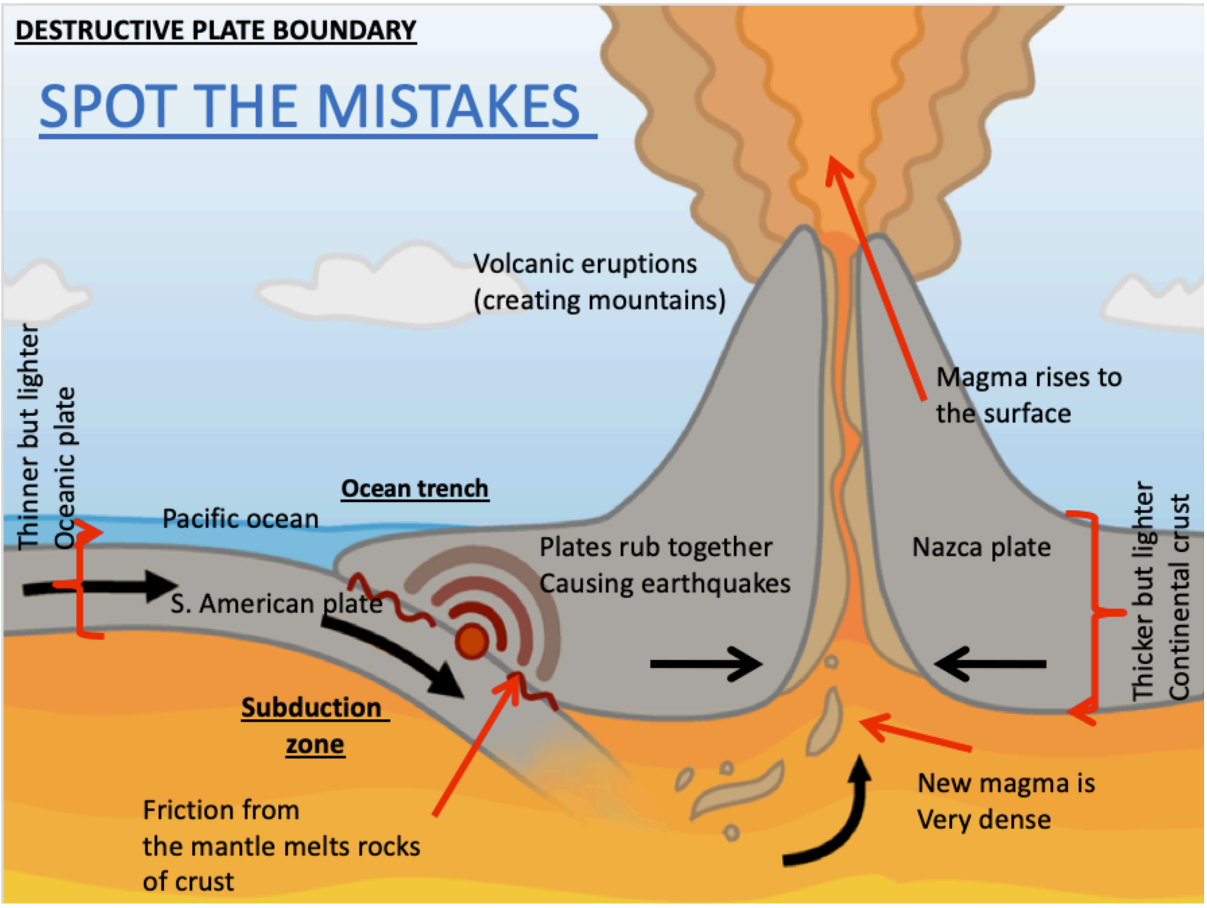


Fold mountains have been formed at times in the Earth's geological history called mountain-building periods. Recent mountain-building movements have created the Alps, the Himalayas, the Rockies and the Andes, some of which are still rising. For this reason, many of these ranges are called young fold mountains.

Ocean trenches

Oceanic trenches are formed where the ocean crust bends downwards and slides back into the mantle on destructive plate margins. Oceanic trenches are long, narrow, deep features in the seabed. Most are deeper than 6km. The Mariana Trench, in the western Pacific Ocean, is 11km deep, 2,500 km long and has an average width of just 70km.





Past Paper Question (from 2019)
Explain why ocean trenches are formed where two plates collide.
You may use a diagram to help your answer. [4]

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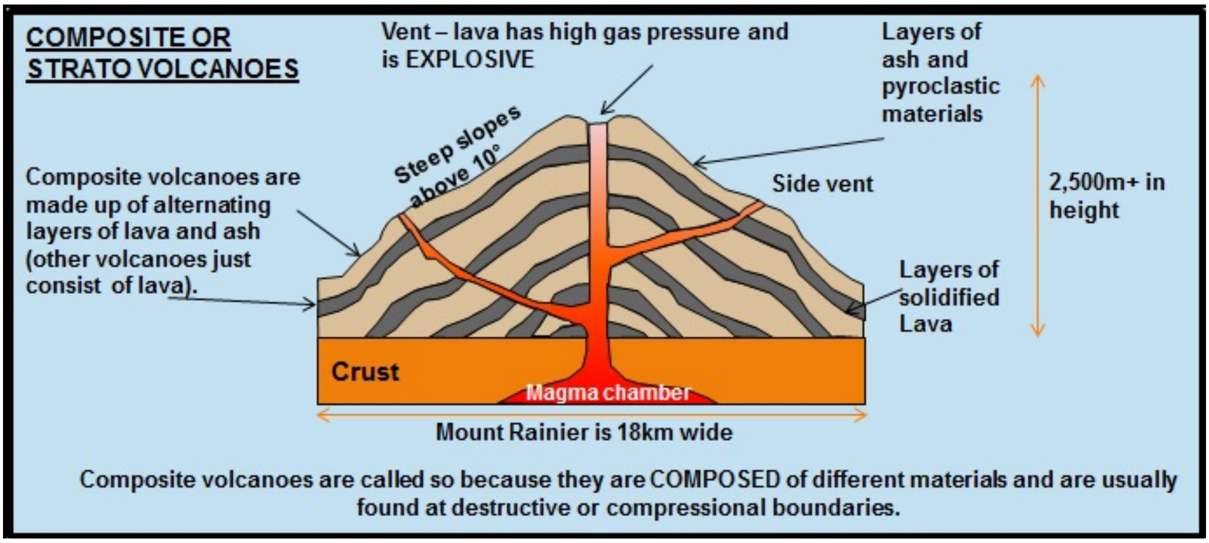
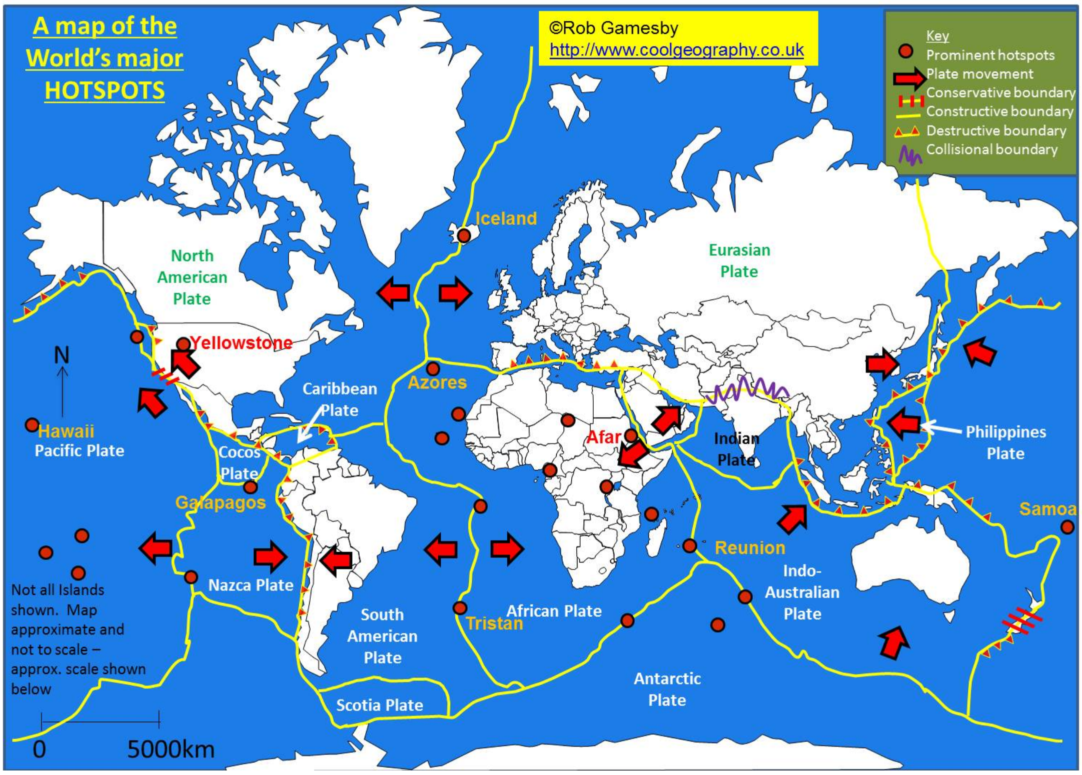
Volcanoes at destructive boundaries tend to have thicker lava that does not flow easily. The magma can solidify in the neck of the volcano and pressure builds in the magma chamber below leading to more explosive eruptions. The volcanoes are composed of lava flows and other ejecta in alternate layers, the strata, that give rise to the name stratovolcanoes (also called composite volcanoes). They are tall, cone shaped (conical) mountains. Examples include Mount Fuji in Japan and Mount Vesuvius in Italy.



What is a volcanic hotspot?

https://www.geolsoc.org.uk/Plate-Tectonics/Chap3-Plate-Margins

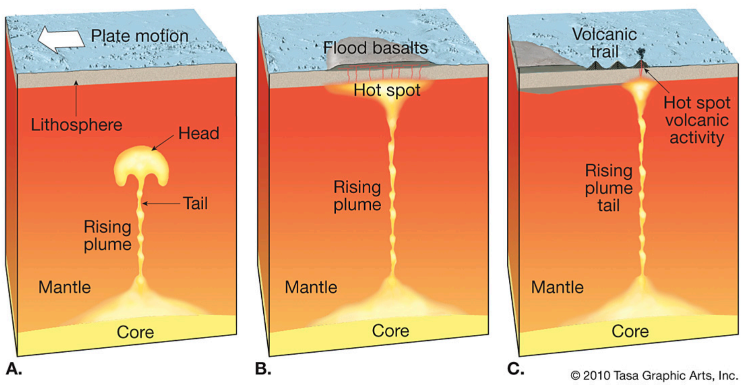
A hot spot can be described as “A small area of the Earth’s crust where an unusually high heat flow is associated with volcanic activity.” Of approximately 125 hot spots thought to have been active over the past 10 million years most are located well away from plate boundaries.



It is the fact that hotspots are not close to plate boundaries that they have posed so much trouble for Plate Tectonic Theory, as they do not fit with the fact that most seismic and volcanic activity happens at plate margins. There are several fantastic examples of volcanic activity that occurs away from the edges of plates, including relic features such as the Deccan Traps in India, oceanic features such as the Hawaiian Islands and Iceland, and continental features such as the Yellowstone super volcano.

There are a number of theories about the hot spot anomaly.

The first is that intensive radioactivity in the Earth’s interior creates a huge column of upwelling lava, known as a ‘plume’. The plume of plastic rock from the asthenosphere pushes upwards; pressure drops and the plastic rocks become molten, melting and pushing through the crust above. This lies at a fixed position under the tectonic plate. As the plate moves over this ‘hot spot’, the upwelling lava creates a steady succession of new volcanoes that migrate along with the plate. The plume also eats into or melts the plate above, so that the thickness of the crust at this point is much smaller than the average. These domes or plumes of plastic rock can be up to 1,000 km across.

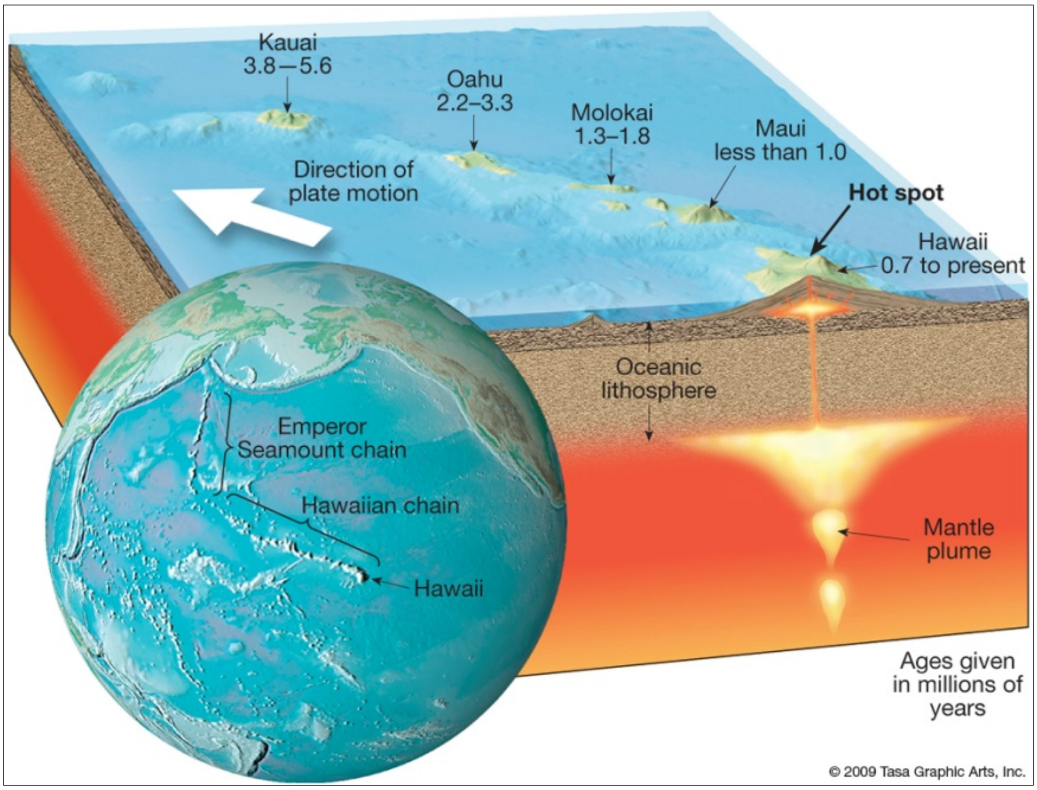


Alternative hot spot theories

Whilst the idea of upwelling mantle plumes is commonly referred to as the cause of hot spots, the mechanisms by which hot spots are created are still under debate. It has been suggested that hot spots may be created due to a thinning of the lithosphere when it experiences local extension (tensional forces). It has also been put forward that due to episodes of oceanic plate subduction in the past, there may be higher concentrations of water in some parts of the mantle than others and that hot spots may exist due to the presence of this water, which drives the hot spot activity by a process called hydration melting.

The Hawaiian Hot Spot

The Hawaiian Islands are a chain of very large mountains formed by volcanic activity, but they are not close to a plate boundary. The Hawaiian Islands have formed over a volcanic hotspot in the middle of the Pacific Plate. The nearest plate boundary is 3,200km away. The diagram shows that as the Pacific Plate moves slowly across the hotspot, magma rises through the crust forming a volcanic island. As time passes, the plate moves but the hotspot stays in the same place, so that new shield volcanoes are formed behind a line of increasingly older islands that contain extinct volcanoes.



The real geology behind Pixar's short film 'Lava'
https://www.youtube.com/watch?v=uh4dTLJ9q9o
https://io9.gizmodo.com/the-real-geology-behind-pixars-short-film-lava-1713976956

Pixar's geological love story Lava isn't just meant to evoke the tropical islands of Hawaii; it's actually inspired by a real underwater volcano off the coast of the Big Island. We spoke to the short film's director and learned about the real geology simmering beneath Lava. Spoilers for Lava ahead.
"I took my family on vacation to the Big Island," Lava director James Ford Murphy told us in an interview. "We took a helicopter tour and I saw Kīlauea and that was huge. Then, on the last day, we were all kind of sad and leaving and we were walking through this shopping mall that had this diorama of the Big Island. And it's five volcanos that form the Big Island that have all merged together over time. But then there's this little sign on the bottom that said 'Lōʻihi.' And I was like, 'What is Lōʻihi?'
"So when I got home, I started doing my research and I found out that it is an underwater volcano that is slowly going to connect [to the Big Island]. And that just blew my mind, because I just thought, 'Does Lōʻihi know that the Big Island is up here? And does the Big Island know that Lōʻihi [is down there]? And what if they didn't know?'"
From that moment of anthropomorphism came the seeds of Lava. And just as a real volcano inspired the film, Murphy and his team used real places to construct their volcanic characters. Up top, you can see an image from a presentation that Murphy delivered at Pixar outlining where many of the male volcano Uku's physical features came from. (Click the magnifying glass in the top left corner to see a bigger version of the image.) You can see elements of Kauaʻi's Nā Pali Coast in Uku's arms, for example, and the strata in his face were modeled after Waimea Canyon, also in Kauaʻi. "It's so appealing," said Murphy. "The sun has baked it."
The female volcano Lele, particularly at her base, was also inspired by the Nā Pali Coast. Her hair comes from the lava fields of Kīlauea, where you can see the black waves of hardened lava. "We were very specific," Murphy said. "It's not like you're actually going for it to look exactly like that, but you want to be very specific."
The waterfall that forms at the end of the short, when Uku joins with Lele to form the musical island of Ukulele, was inspired by Papalaua Falls on the northern cliffs of Molokai. Like the very notion of the Lōʻihi Seamount, the look of that waterfall appealed to Murphy's tendency to anthropomorphize. "There's this great video I saw on it and I could just imagine two faces sharing this waterfall." So that became the central image of the happy ending to Murphy's love story.

<u>**What are the processes that result in distinctive volcanic landscape features?**</u>

Larger scale features include shield volcanoes, stratovolcanoes and caldera.

A volcano is a cone-shaped mountain formed by surface eruptions from a magma chamber inside the Earth. The magma that reaches the surface in an eruption is called lava, and is one of the many different products that can be thrown out, including ash, cinders, pumice, dust, gases and steam. The world distribution of active volcanoes shows an almost perfect fit with the locations of the tectonic plate margins.

How are volcanoes formed?

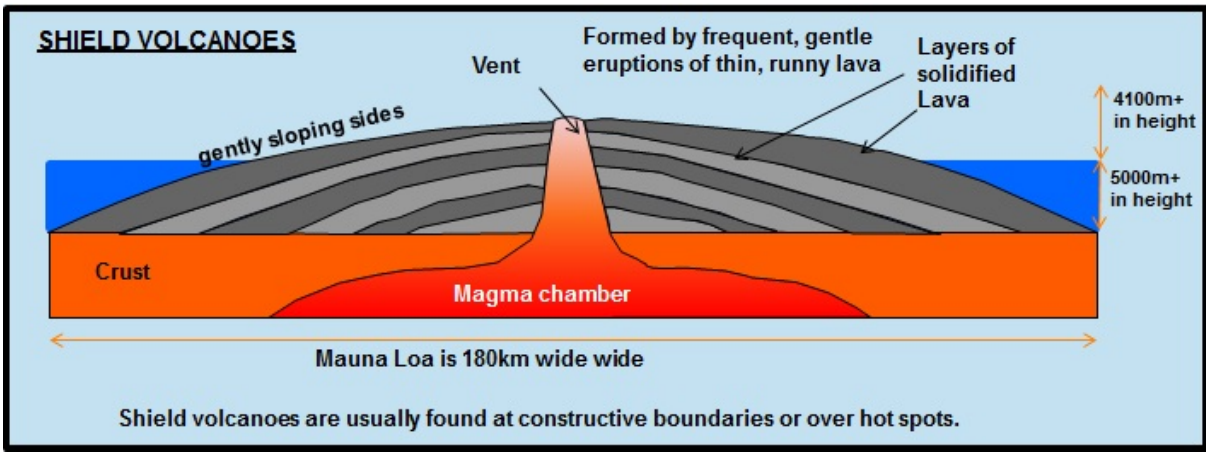
Volcanoes form where magma escapes through a vent, which is a fracture or crack in the Earth's crust. This happens most often at plate margins. Lava and other products are thrown out from the circular hole at the top called the crater. Each time an eruption takes place, a new layer of lava is added to the surface of the volcano; since more accumulates closer to the crater during every eruption, a mountain that is cone-shaped is formed.

Different types of volcanoes

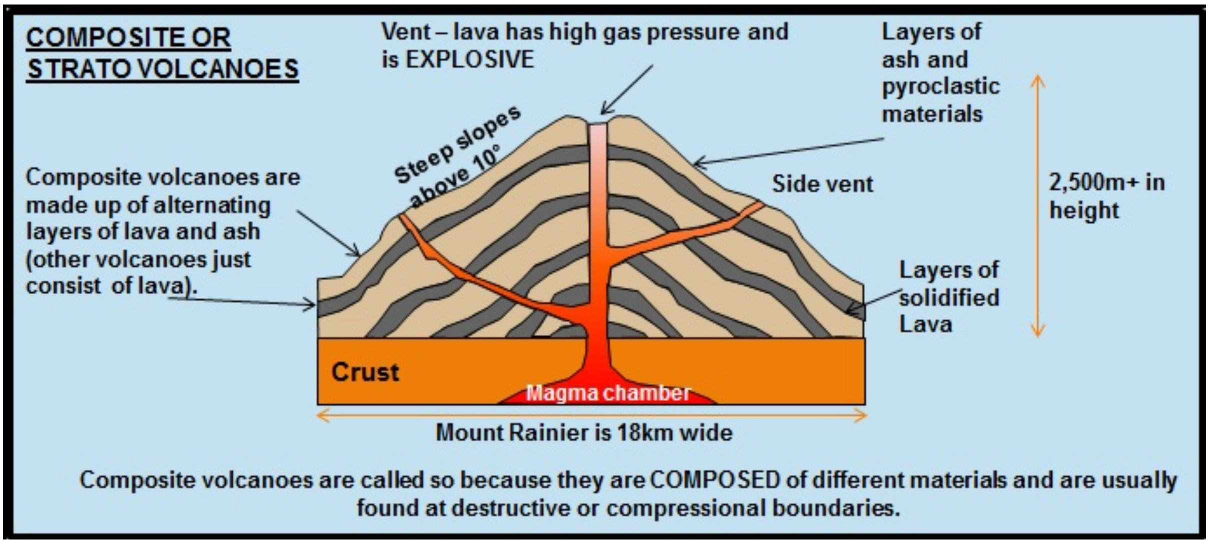
Volcanoes are divided into two main types, depending upon the material thrown out in an eruption and the form (height and shape) of the volcanic cone produced. The shape of the volcano depends on the type of magma and its gas content. These differences are shown in the table below.

Basically, the division is between volcanoes formed along constructive plate margins and along destructive margins, because of the different types of lava emitted. Along constructive margins the basic lava that has come from within the mantle has a low silica content and low gas content: it pours out easily, is runny and flows long distances, building up shield volcanoes. These volcanoes have gentle slopes and a circular shape.

Examples include Erta Ale in Ethiopia.



Volcanoes at destructive boundaries tend to have acid lava with a high silica content and high gas content. As a result, the lava is more viscous (sticky) and so it travels shorter distances before cooling; these are more explosive volcanoes. After an eruption the vent becomes blocked, which results in great pressure building up before the next eruption. During explosive eruptions lava is shattered into pieces so that bombs, ash and dust are showered over a wide area. Pyroclastic flows can occur. The volcanoes are composed of lava flows and other ejecta in alternate layers, the strata, that give rise to the name **stratovolcanoes** (also called composite volcanoes). They are tall, cone shaped (conical) mountains. Examples include Mount Fuji in Japan and Mount Vesuvius in Italy.



This is the Osorno volcano in Chile.
Is it a stratovolcano or a shield volcano? Explain your answer. (3)

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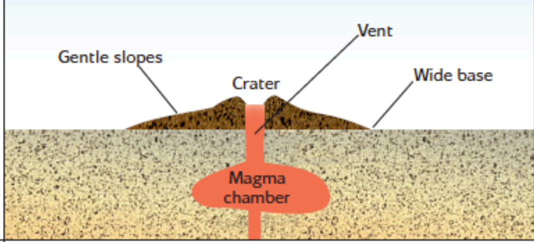
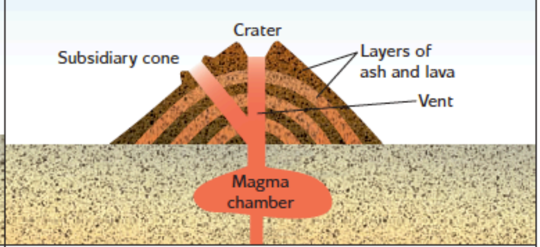
Plate margin	**Constuctive** (Figure 4, page 7)	**Destructive** (Figure 3, page 7)
Formation	As the plates move apart, magma rises upwards from the mantle to fill the gap. This adds new rock to the spreading plates. Some of the magma may also be forced out to the surface through a vent. Some volcanoes grow high enough to form volcanic islands.	When the plates collide, the denser oceanic plate is pushed down into the mantle. Here the plate melts and is destroyed in the subduction zone. In the subduction zone the plate forms a pool of magma. The great heat and pressure may force the magma along a crack where it erupts at the surface to build up a volcano.
Form of volcano	**Shield volcano (basic lava)** 	**Composite cone volcano** 
Characteristics	• cone with wide base and gentle slopes • made of lava only • regular and frequent eruptions • lava pours out with little violence	• tall cone with narrow base and steep sides • made of alternate layers of lava and ash • irregular with long dormant periods • violent explosions possible
Examples	Hekla and Surtsey in Iceland Mauna Loa and Kilauea in Hawaii	Etna, Vesuvius and Stromboli in Italy Krakatoa in Indonesia

One feature of a stratovolcano is pyroclastic flow.
Describe two other features of a stratovolcano. *(from 2018)* (4)

1. ____

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2. ____

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Compare shield and stratovolcanoes. (3)

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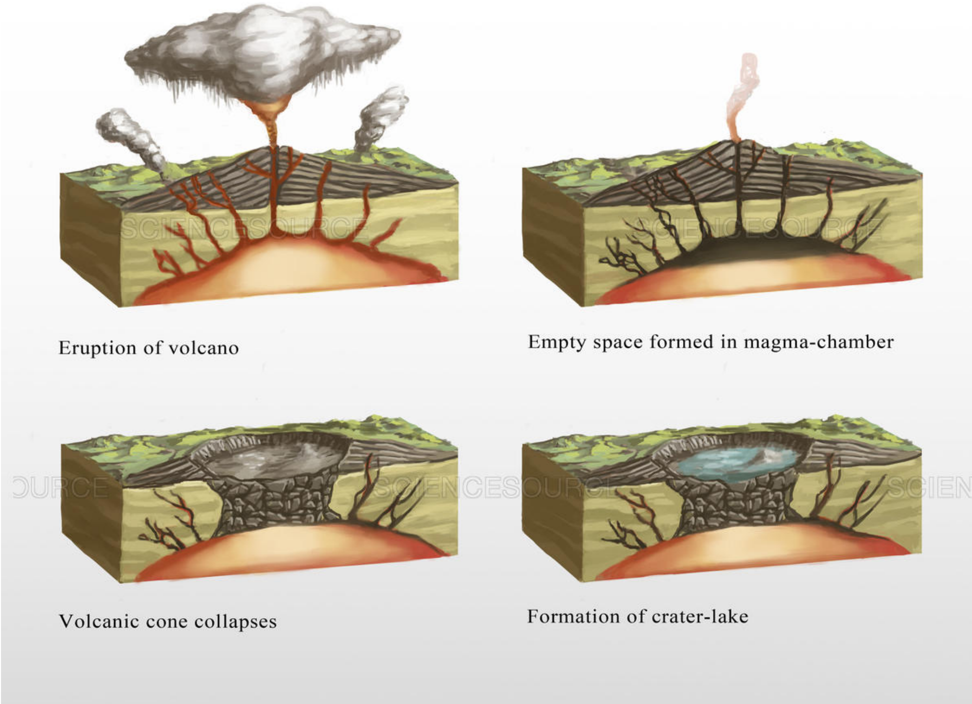
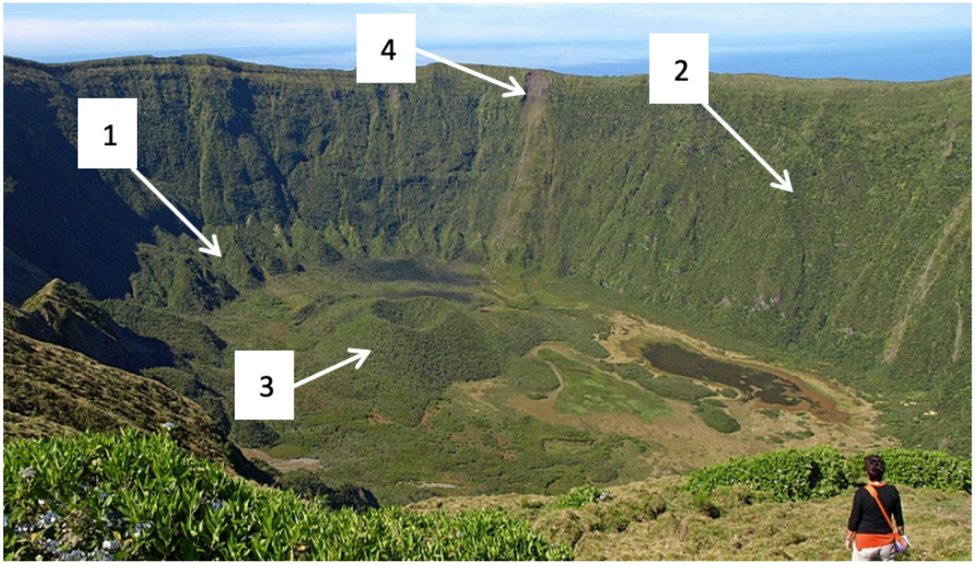
Caldera

https://www.youtube.com/watch?v=BBGmXsZHInw

In some violent eruptions, so much lava and ash is ejected that the magma chamber supplying the volcano empties. The upper part of the volcano collapses into the empty space below creating a circular depression which is larger than a typical volcanic vent. These features are called calderas (from the Spanish word for cauldron). Calderas vary greatly in size. The caldera on Faial, in the Azores is 2km across and 400m deep. The Yellowstone caldera, in North America was formed by a much more explosive eruption and, consequently, is much larger. This caldera is 55km by 72km across.





A view into the caldera on Faial, the Azores.

The steeply sloping wall of the caldera is 400m high		A recent landslide on the steep slope has removed all vegetation	
A small cinder cone with a central vent is at the bottom of the caldera		Piles of scree at the foot of the caldera wall from old landslides	

Which of the features in this photograph is the most recent and why?

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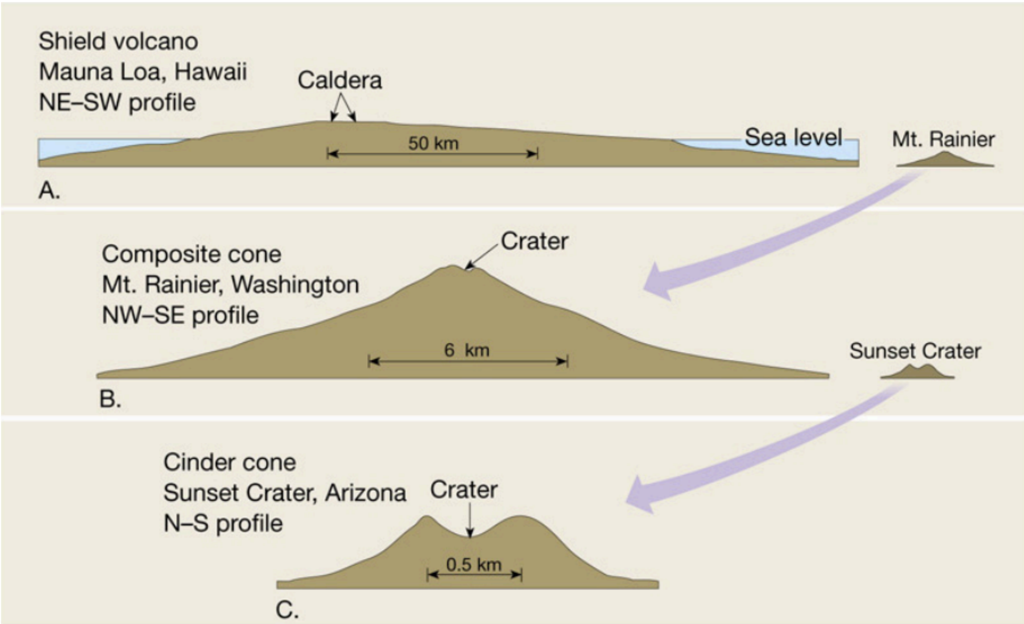
What are the processes that result in distinctive volcanic landscape features?

Smaller scale features include cinder cones, lava tubes and geysers.

Cinder Cones
https://www.youtube.com/watch?v=Eqc2zaWS3XA

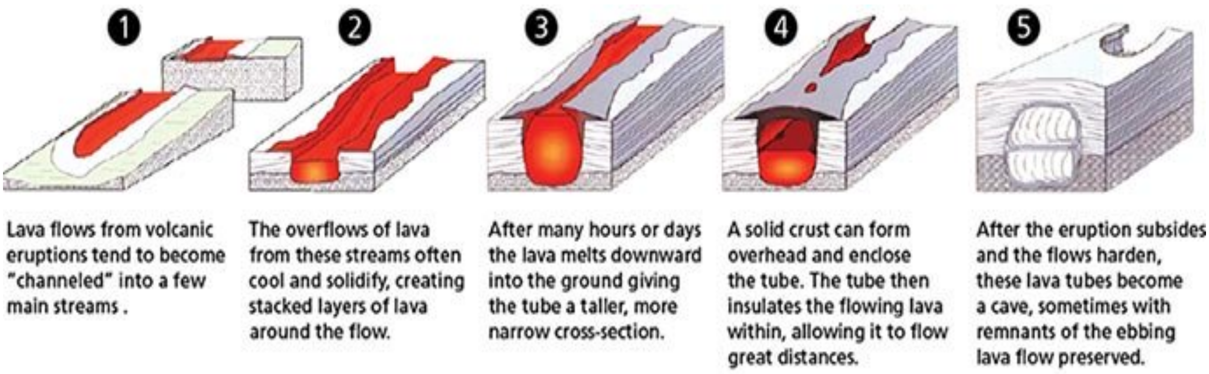
The smallest, most common type of volcano is a cinder cone. These cone-shaped hills can be found on their own (such as Paricutin, Mexico) or on the slopes of other, larger volcanoes. They are made from cinders (or **scoria**) created when lava is ejected into the air from a single vent. The lava spray cools very quickly as it is thrown through the air, falling to the ground as hot cinders. These build up around the vent to from a steep sided, circular cone. Cinder cones usually form during a single eruption. This explains why they don't reach the size of composite (stratovolcanoes) volcanoes, which evolve over many eruptions.



Lava tubes
https://edition.cnn.com/videos/travel/2016/06/21/hawaii-volcanoes-national-parks-ncc-orig.cnn

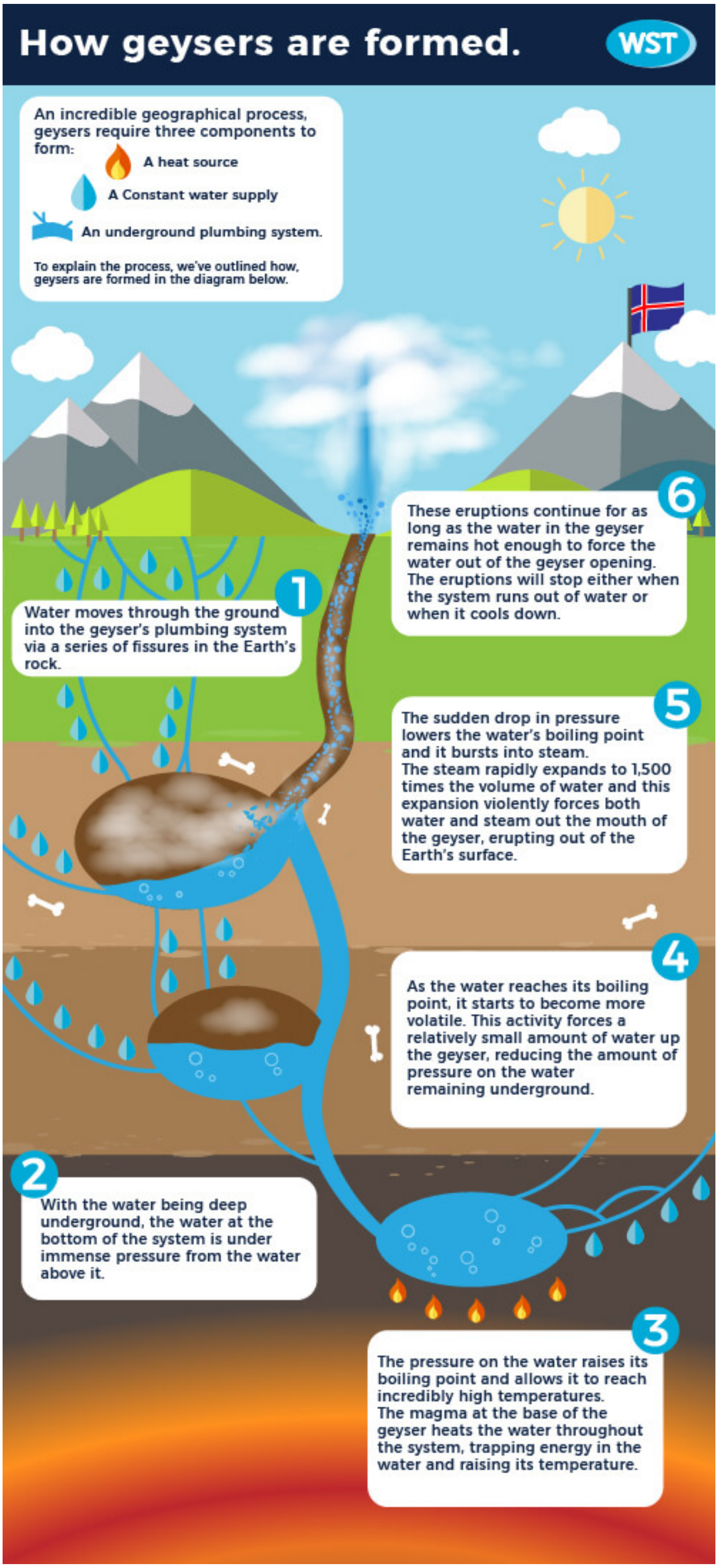
A lava tube on the lower slopes of Mount Pico, the Azores

Lava tubes, are formed in a geological instant—a year or t
eruption from the Earth's crust.
Most lava tubes are formed by a type of syrupy flow called pahoehoe. As it pours down the volcano, the lava at the surface is cooled by the air and solidifies, creating an elastic, skin like outer layer. Beneath this 'skin', the lava continues to ooze, eroding the ground beneath it and carving underground tunnels. Now insulated from the air, the hot lava can surge unimpeded, often for many miles. Underground rivers of lava can flow just below the surface of the ground as far as 50km from the volcano's crater before cooling enough to solidify. As the eruption stops, the liquid lava drains away and an empty lava tube is left. These lava tubes are typically oval in cross section, 5-10m wide, 1-5m high and hundreds of metres in length. Some tubes have branching patterns where tributary rivers of lava have joined one another.



Geysers

In many volcanic regions, water interacts with heat in the ground to create thermal features such as geysers, hot springs, fumaroles and mud pots. These small-scale features are formed when rainwater or snowmelt percolates downwards and meets hot rocks. The water is heated and expands. This increases the pressure and forces a mixture of boiling water and steam back up through the fissures in the ground. It sometimes emerges in spectacular hydrothermal explosions that send columns of steam high into the air. Repeated explosions of a geyser can create a small, crater, a few meters in diameter.



(i) Tick (✓) **two** features found at destructive plate margins in the list below. [2]

Feature	Tick (✓) two
Shield volcano	
Stratovolcano	
Rift valley	
Mid-ocean ridge	
Ocean trench	

From Eduqas 2018

(iii) Complete the following paragraph choosing your answers from the box below. [4]

mantle	rift valleys	core	constructive
subduction	conservative	convection	divergence
destructive	stratovolcanoes	crust	hot spots

The Earth's .... is made up of segments called plates which move relative to each other. At **X**, the Caribbean Plate is colliding with the North American Plate. This is called a .... plate margin where the process of .... leads to one plate sinking underneath the other and melting. Landforms like .... are often formed at this type of boundary.

From WJEC 2019

Explain why the process of subduction occurs at destructive plate margins. [4]
(from Eduqas 2018)

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