Types of Plate Margin

The next couple of pages build on some of the stuff you should have learnt at GCSE. It's not the most difficult of topics (I'm saving those for later...) but it's vital nonetheless — so put on your favourite revision hat and get ready to take it all in.

Earthquakes and Volcanoes Occur at Constructive Margins

1) A **constructive margin** occurs where two plates are moving **APART** (diverging).
2) The mantle is under **pressure** from the plates above. When they move apart, the pressure is **released** at the **margin**.
3) The release of pressure causes the mantle to **melt**, producing **magma**.
4) The magma is **less dense** than the plate above, so it **rises** and can **erupt** to form a **VOLCANO**.
5) The plates **don't** move apart in a **uniform way** — some parts move faster than others. This causes **pressure to build up**. When the pressure becomes **too much** the plate **cracks**, making a **fault line** and causing an **EARTHQUAKE**. **Further earthquakes** may also occur along the fault line once it's been created.
6) Constructive margins create **two different landforms**, depending on where they are:

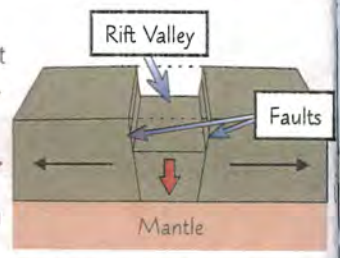
A fault line is where a plate has cracked under pressure.

MID-OCEAN RIDGE

1) Where diverging plates are **underwater**, a **mid-ocean ridge** forms (see page 3). For example, the **Mid-Atlantic Ridge** is where the **Eurasian plate** and **North American plate** are moving apart.
2) **Underwater volcanoes** erupt along mid-ocean ridges and they can **build up** to be above sea level. For example, **Iceland** has been formed by the build-up of underwater volcanoes along the Mid-Atlantic Ridge.

RIFT VALLEY

1) Where plates diverge **beneath land**, rising **magma** causes the continental crust to **bulge** and **fracture**, forming **fault lines**.
2) As the plates keep moving apart, the **crust** between parallel faults **drops down** to form a **rift valley**. For example, the **East African Rift System** is a series of rift valleys that stretches from **Mozambique** to the **Red Sea** — about 4000 km. It's formed because the **Nubian** and **Somalian** plates are diverging. Some parts of the system are hundreds of metres deep and thousands of metres wide.
3) **Volcanoes** are found around rift valleys. For example, **Mount Kilimanjaro** and **Mount Kenya** (the two highest mountains in Africa) are volcanoes in the **East African Rift System**.

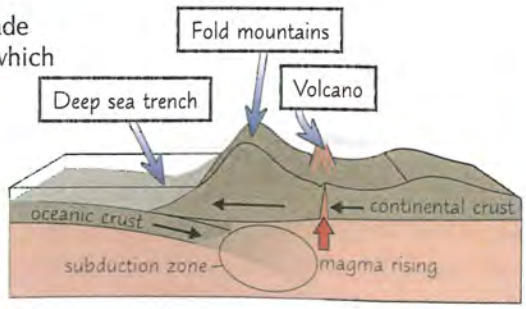


Earthquakes and Volcanoes Also Occur at Destructive Margins

A **destructive margin** occurs where two plates are moving **TOWARDS EACH OTHER** (converging). What happens at these margins depends on the **types of plates** converging:

Oceanic-Continental

1) Where **continental crust** and **oceanic crust** converge, the **more dense oceanic** crust is **forced under** the **less dense continental** crust (it's **subducted**). This forms a **DEEP SEA TRENCH** (a very deep trench in the sea — e.g. the **Peru-Chile trench** in the Pacific Ocean).
2) **FOLD MOUNTAINS** also form where the plates meet. They're made up of **sediments** that have accumulated on the continental crust, which are **folded upwards** along with the **edge** of the **continental crust**.
3) The oceanic crust is **heated** by **friction** and **contact** with the upper mantle, which melts it into **magma**.
4) The magma is **less dense** than the continental crust above and will **rise** back to the surface to form **VOLCANOES**.
5) As one plate moves under the other they **can get stuck**. This causes **pressure** to **build up**. When the pressure becomes **too much** the plates **jerk** past each other, causing an **EARTHQUAKE**.



Oceanic-Oceanic

1) Most of the same processes occur where two plates of **oceanic crust** are moving towards each other — the **denser** of the two will be **subducted**, forming a **DEEP SEA TRENCH** and triggering **EARTHQUAKES** and **VOLCANIC ERUPTIONS**.
2) **Volcanic eruptions** that take place **underwater** (e.g. when two plates of oceanic crust converge) create **ISLAND ARCS** — clusters of islands that sit in a curved line, e.g. the **Mariana Islands**.

Types of Plate Margin

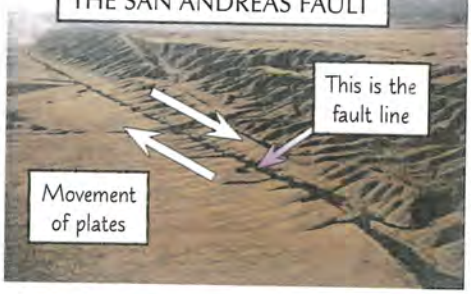
Continental-Continental

1) Where two plates of **continental crust** move towards each other, **neither** is subducted so there **aren't any volcanoes** — but the pressure that builds up between them can cause **EARTHQUAKES**.
2) **FOLD MOUNTAINS** form when continental crusts converge. E.g. the **Himalayas** were created in this way.

Only **Earthquakes** *Occur at* **Conservative** *Plate Margins*

1) A **conservative margin** occurs where two plates are moving **PAST EACH OTHER**.
2) The two plates get **locked together** in places and **pressure builds up**. As with destructive margins, this causes the plates to **jerk** past each other (or to **crack**, forming **fault lines**), releasing the **energy** as an **EARTHQUAKE**.
3) For example, the **Pacific plate** is moving past the **North American plate**. Many earthquakes occur along this margin and along its fault lines, e.g. along the **San Andreas fault** in **California**.

AERIAL PHOTOGRAPH OF THE SAN ANDREAS FAULT



Here's a **Summary** *for Each Plate Margin — Learn It*

Have a look back at the map on page 2 — it'll tell you where the plates are.

Type of margin		Example	Landforms	Earthquakes?	Volcanoes?
Constructive		Eurasian plate and North American plate	• Mid-ocean ridges (when underwater) • Rift valleys (when under land)	Yes	Yes
Destructive	Oceanic-Continental	Nazca plate and South American plate	• Deep sea trenches • Young fold mountains	Yes	Yes
	Oceanic-Oceanic	Pacific plate and Philippine plate	• Deep sea trenches • Island arcs	Yes	Yes
	Continental-Continental	Indo-Australian plate and Eurasian plate	Fold mountains	Yes	No
Conservative		North American plate and Pacific plate	Low ridges	Yes	No

Practice Questions

Q1 Name the two landforms that are created at constructive margins.
Q2 Explain what happens when two continental plates meet.
Q3 Name the two types of plate margin where no volcanic activity takes place.
Q4 Give one example of each type of plate margin.

Exam Questions

Q1 Describe the features of constructive plate margins. [8 marks]

Q2 Compare and contrast margins where two oceanic plates are converging with margins where two continental plates are converging. [8 marks]

Tectonic plates are great — but they do have their faults...

Well that wasn't too bad at all, and you even got out of a 40-mark exam question. Hmm, maybe I've been a bit lenient with you — too much carrot and not enough stick. Right then, before you can move on to the next couple of pages you have to know every little bit about each of these types of plate margin, as well as an example. And yes, I do mean every little bit — get learning.

Volcanic Activity

These pages cover all your classic eruption-style volcanic activity, but they also go that little bit further. Yep, not all lava's the same you know, and we're also talking bubbling pools of mud, fountains of steam and plumes of magma.

Volcanic Activity can be Intrusive or Extrusive

1) The **high pressure** inside the Earth keeps rocks in some parts of the mantle **semi-molten**.
2) When this pressure is **released**, e.g. at constructive boundaries, the rocks become **molten**. The hot molten rock is called **magma**.
3) Because magma is **less dense** than the rock around it, it **rises up** towards the Earth's surface.
4) **Most** magma **doesn't reach the surface**, but some does — the type of **volcanic activity** depends on where the magma ends up:

Once magma erupts from the Earth's surface it's called lava.

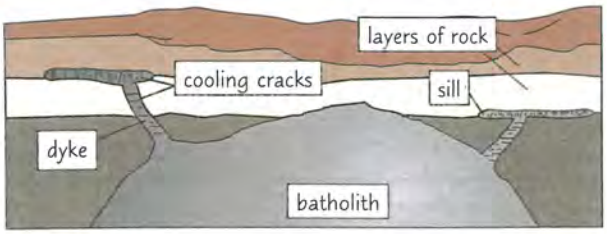
INTRUSIVE volcanic activity

- This takes place **BENEATH** the **Earth's surface**.
- It includes the formation of **large magma chambers** and **magma** being **forced into the crust** (through cracks in the rock).

EXTRUSIVE volcanic activity

- This takes place **ON** the **Earth's surface**.
- The **major form** of this activity is **volcanic eruptions** of **lava** and other material.
- **Minor types** of extrusive volcanic activity include **hot springs**, **geysers** and **boiling mud pools**.

Intrusive Volcanic Activity forms Dykes, Sills and Batholiths



1) When large chambers of magma **cool underground** they form domes of igneous rock called **batholiths**.
2) Where the magma has flowed into **gaps** in the surrounding rock and cooled it forms vertical **dykes** (across the layers of rock) and horizontal **sills** (between the layers of rock).
3) Cracks may form as the magma cools — these are called (wait for it...) **cooling cracks**. In a sill they're **vertical**, and in a dyke they're **horizontal**.

Batholiths (e.g. the Sierra Nevada batholith in the US) can become exposed if the rock layers above them are eroded away.

Lava Eruptions are a form of Extrusive Activity

1) There are **three** main types of lava:

- **BASALTIC lava** is made at **CONSTRUCTIVE** plate margins.
- **ANDESITIC lava** is made at **DESTRUCTIVE** plate margins.
- **RHYOLITIC lava** is made at **DESTRUCTIVE** plate margins.

2) The **different types** of lava have **different chemical compositions** — and it's the chemical composition that controls the **viscosity** (thickness) and **temperature** of the lava:

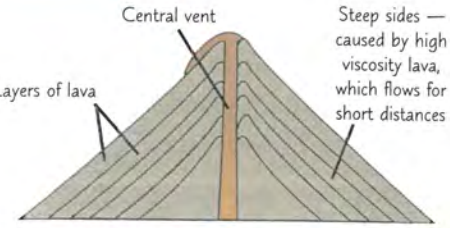
	BASALTIC LAVA	ANDESITIC LAVA	RHYOLITIC LAVA
Silica content	Low	Medium	High
Viscosity	Low (runny)	Medium	High (thick and sticky)
Temperature of eruption	Over 950 °C (usually 1100 - 1200 °C)	750 - 950 °C	Less than 750 °C

3) **Basaltic lava** has a **low viscosity** so it flows easily and gas can escape from it easily. As a result, eruptions of basaltic lava **aren't violent**. Basaltic lavas usually erupt **frequently** and for **long periods** of time.
4) **Andesitic** and **rhyolitic lavas** have a **higher viscosity** than basaltic lava. They flow less easily, and often form **blockages** in volcanic vents. Also, volcanic gases can't escape easily from viscous lava. **Pressure** builds up because of the lava blockages and trapped gases, until the blockages are cleared by a **violent eruption**. Andesitic and rhyolitic lavas usually erupt **intermittently** (every once in a while) and the eruptions are **short-lived**.

Volcanic Activity

There are Lots of Different Types of Volcano

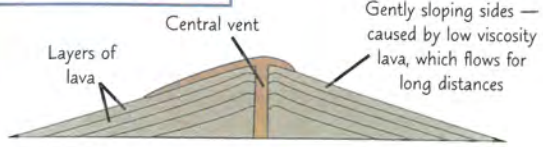
DOME VOLCANO



Often occur at **destructive** margins, e.g. **Puy de Dome** in **France**. The lava from dome volcanoes tends to be either **rhyolitic** or **andesitic**.

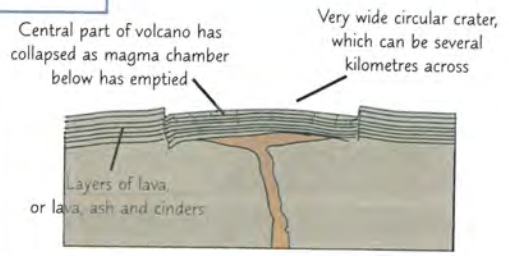
A composite volcano (or stratovolcano) is similar to a dome volcano except that it has layers of lava alternating with layers of ash and cinders.

SHIELD VOLCANO



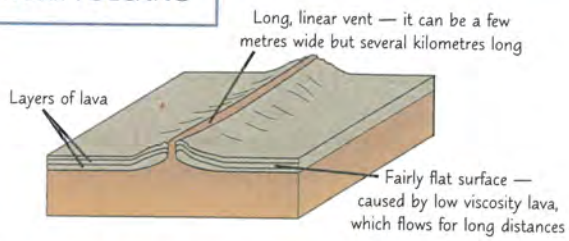
Often occur at **constructive** margins or **hotspots** (see p. 10), e.g. **Mauna Loa** in **Hawaii**. Shield volcanoes usually produce **basaltic lava**.

CALDERA



Often occur at **destructive** margins, where they produce **andesitic** and **rhyolitic lavas**, e.g. **Aira Caldera** in **Japan**.

FISSURE VOLCANO



Also called a fissure vent or volcanic fissure. Often occur at **constructive** margins, e.g. **Laki Fissure System** in **Iceland**. Fissure volcanoes usually produce **basaltic lava**.

Hot Springs are Springs... of Hot Water

1) **Springs** are places where **groundwater** emerges at the **surface**.
2) If the **groundwater source** of a spring flows **close** to an area of recent **intrusive volcanic activity**, the water is heated and the spring becomes a **hot spring**.
3) The **temperature** of hot springs varies from around **20 °C** to over **90 °C**.
4) Hot spring water often has a **high mineral content** because hot water can hold a lot of dissolved solids.
5) Hot springs are found **all over the world** and are often popular with **tourists**, e.g. the springs in **Rio Hondo** (Argentina) and **North Island** (New Zealand).

Geysers are Hot Springs where the Water Erupts

Hot springs, geysers and mud pools are often called geothermal features.

1) Geysers are a type of hot spring where **hot water** and **steam** are ejected from the surface in a **fountain**. They form in areas of **intense volcanic activity** — this is what happens:

- **Groundwater** is **heated** to above **boiling point** by **magma** deep in the crust.
- The hot water becomes **pressurised** and forces its way to the surface along **cracks** in the rocks. Finally, the hot water and steam spray out from a **vent**.

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The Strokkur Geyser in Iceland

2) Geysers **erupt periodically**. This is because they only erupt when the **pressure** has built up enough to **force** the water **out of the ground**.
3) Examples of geysers are **Strokkur** (Iceland) and **Old Faithful** in Yellowstone National Park (USA).