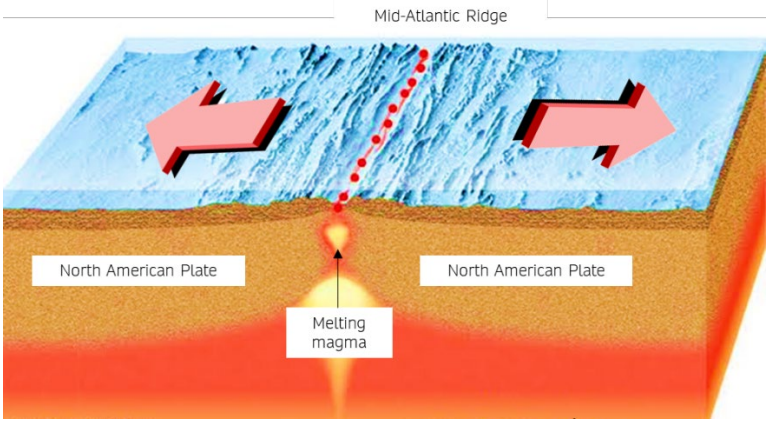
Divergent, convergent and transverse boundaries

When plates move, the continents sitting on top of them move as well. Plates can either;

- Move away from each other – divergent boundary
- Move towards each other – convergent boundary
- Move sideward pass each other – transverse boundary



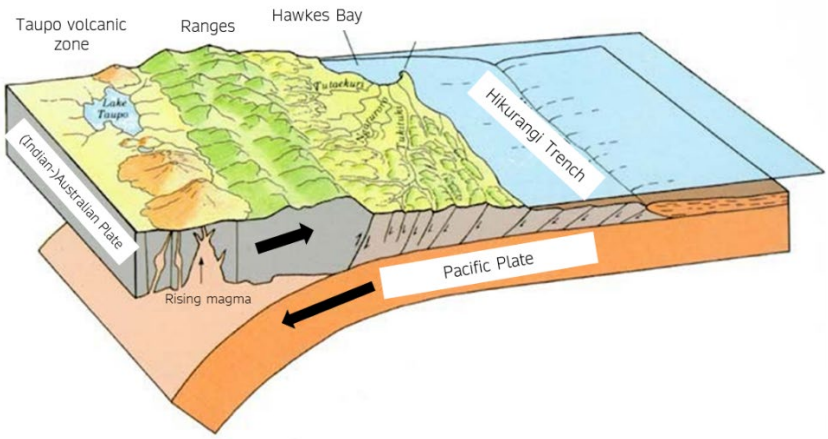
A **divergent boundary** is where the tectonic plates are separating.

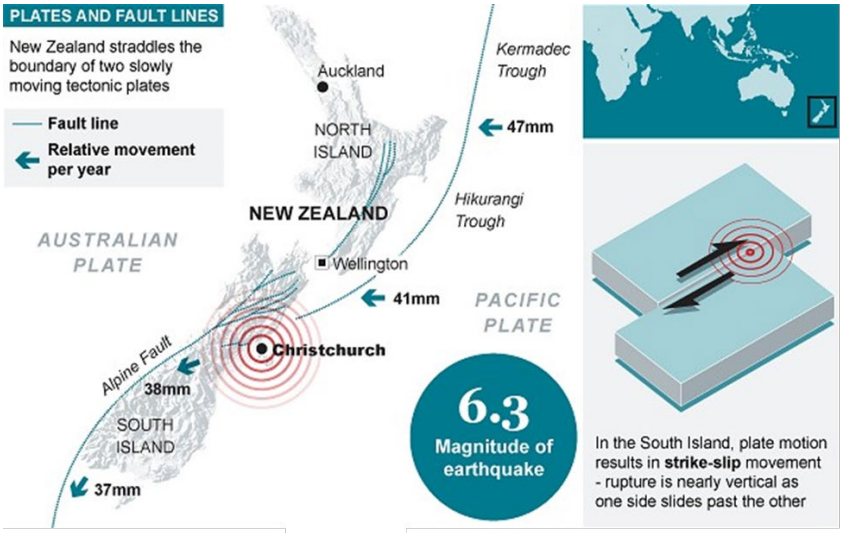
In divergent boundaries under the ocean new crust is made from cooling magma oozing up between the plates.

Some divergent boundaries on land are places where the crust is sinking downward as it is stretched thin.

A **Convergent Boundary** is the opposite of a divergent boundary. Typically, you will see a converging boundary on a tectonic plate that is on the opposite side of a divergent boundary.

As the plates collide mountains are often built at these boundaries as one plate is pushed upwards. Earthquakes and volcanoes often occur at these boundaries as well.





https://www.telegraph.co.uk/news/worldnews/australiandthepacific/newzealand/8340205/Christchurch-earthquake-what-is-behind-the-quake.html

Transverse (strike-slip) fault boundaries are places where the two plates are just sliding past each other. This sliding is not a continuous motion but stops and starts as the plates catch against each other, then release suddenly. This sudden movement is called an earthquake, such as when the 2011 Christchurch Earthquake, and they are triggered along fault boundaries.

New Zealand sits on two plate boundaries

https://www.gns.cri.nz/Home/Learning/Science-Topics/Earthquakes/Earthquakes-at-a-Plate-Boundary/Plate-Collision-in-NZ

New Zealand is on top of the Australian plate to the west and the Pacific plate to the east.

In the lower South Island, the Australian plate is pushed under or subducted under the Pacific plate. In the upper South Island, the two plates move past each other at a transverse boundary, creating the Alpine fault. In the North Island the Pacific plate is subducted under the Australian plate.

There is also a weak area in the crust under the central North Island where magma forces through to create volcanoes.

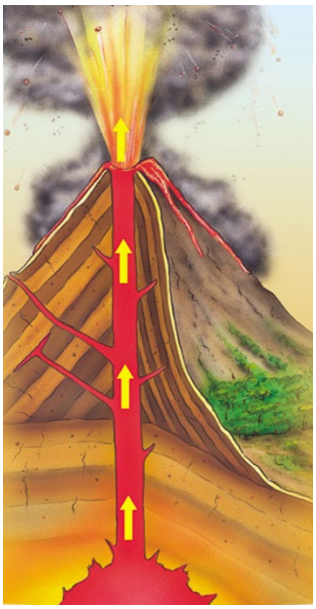
New Zealand's surface features such as the Southern Alps, Lake Taupo and the central plateau have been the result of this plate activity.

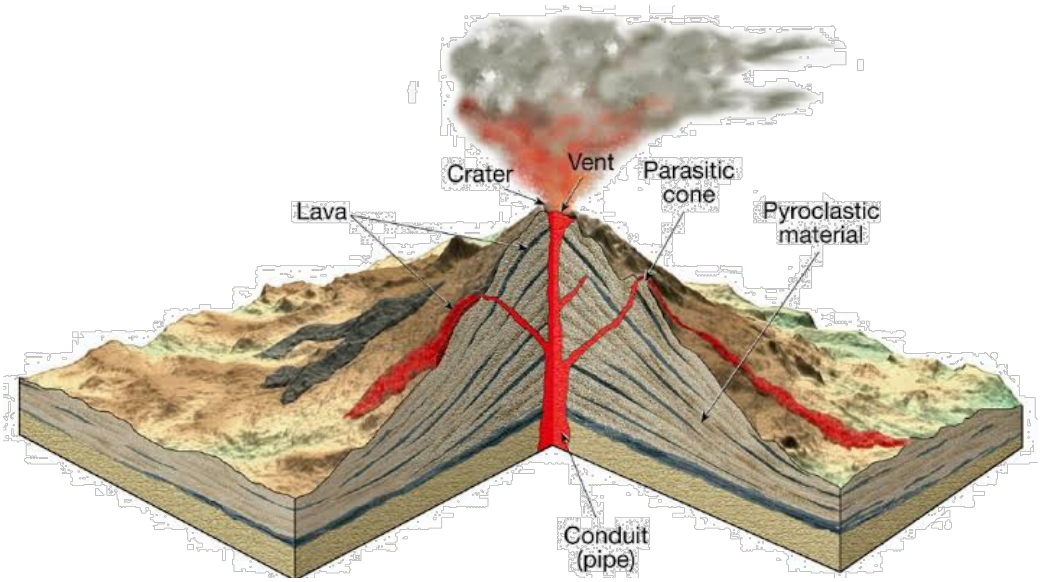
Plate movement results in Volcanic activity

When tectonic plates collide, one plate may slide below the other (called the subduction zone). The sinking plate melts from heat created by friction.

Magma is produced and may force its way to the surface, creating a volcano. The explosive effect is known as an eruption.

A volcano is a place on the Earth's surface where molten rock and gases erupt through the earth's crust. Some volcanoes are just cracking at weak points in the Earth's crust where lava erupts, and some are domes, shields, or mountain-like structures with a crater at the summit.

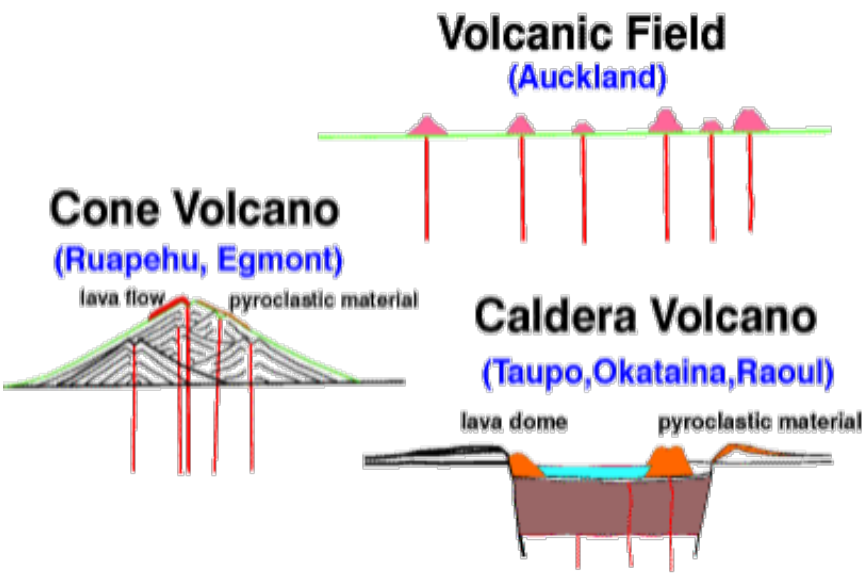




Magma is molten rock within the Earth's crust. When magma erupts through the earth's surface it is called lava. Lava can be thick and slow-moving or thin and fast-moving. Rock also comes from volcanoes in other forms, including ash, cinders (bits of fragmented lava), and pumice (light-weight rock that is full of air bubbles and is formed in explosive volcanic eruptions).

Volcanic activity in New Zealand

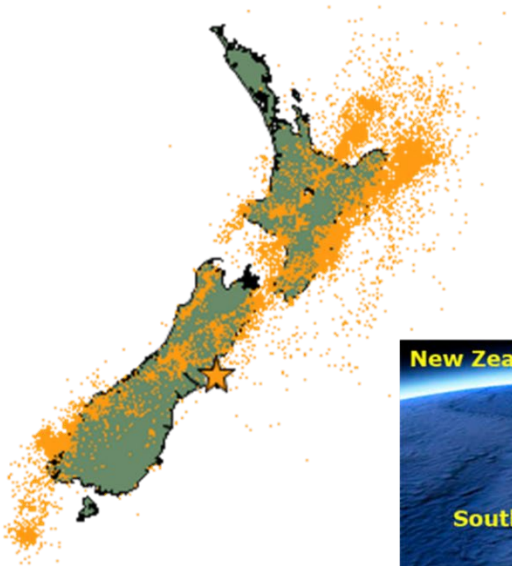
New Zealand has a lot of active volcanoes and a high frequency of eruptions. Most New Zealand volcano activity in the last 2 million years has occurred in the extremely active Taupo Volcanic Zone. We have three major types of volcanoes in New Zealand. The **Volcanic field** is seen in areas such as Auckland. The **Cone volcano** includes three frequently active cone volcanoes; Ruapehu, Tongariro/Ngauruhoe, and White Island. The **Caldera volcano** can be seen at Taupo.



New Zealand has so many active and extinct volcanos because we sit on top of a subducting plate. The hot magma between the two plates is squeezed up through the crust.

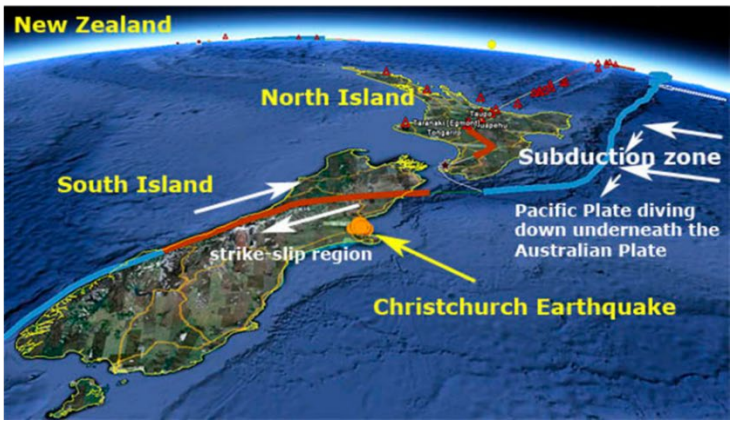
New Zealand lies on the **Pacific Ring of Fire**, where movement of the Pacific plate causes many volcanoes. Some New Zealand volcanoes lie under the ocean on the Kermadec Ridge.

Earthquakes are the result of earths plates moving past each other

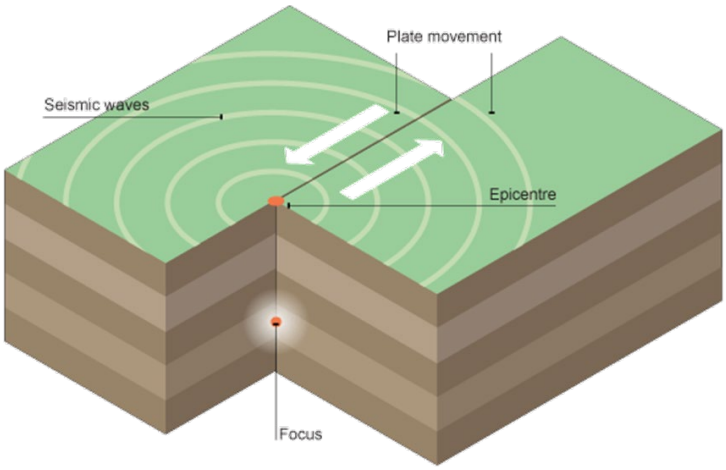


Shallow earthquakes in New Zealand in the past 10 years 2001 - 2011

New Zealand has a high number of earthquakes compared to some other countries around the world. These earthquakes occur because of our location above two tectonic plates.



As plates move the strain causes brittle rock to crack. These cracks, called faults, are often weak zones where more movement or cracking may occur. Constant movement of plates causes pressure to build up at faults, and at the boundaries of the plates. If there is a sudden slippage of rock, this pressure is released quickly, and an earthquake occurs.



Earthquakes occur when two tectonic plates move suddenly against each other. The rocks usually break underground at the hypocentre and the earth shakes. Waves spread from the epicentre, and the point on the surface above the hypocentre. If a quake occurs under the sea it can cause a tsunami.

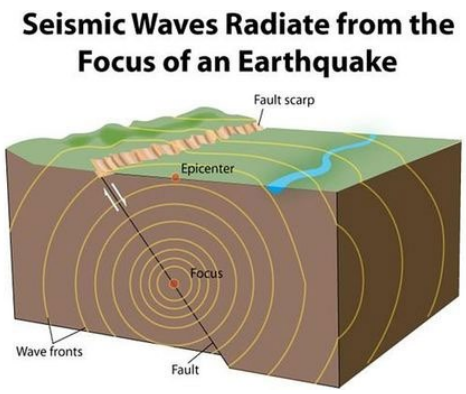
In a **strike-slip fault**, the blocks of rock move in opposite horizontal directions. These faults form when crust pieces slide along each other at a transform plate boundary.

Waves and Faults - EXTENSION

There are 3 main types of seismic waves are generated when faulting triggers an earthquake. All the seismic waves are generated at the same time but travel at different speeds and in different ways. **Body waves** penetrate the earth and travel through it, while **surface waves** travel along the surface of the ground.

Primary and secondary waves are body waves. Primary waves (P-waves) travel the fastest and can move through solids and liquids. The P-wave energy causes the ground to move in a compressional motion in the same direction that the wave is traveling. Secondary waves (S-waves) are slower and travel only through solids. The S-wave energy causes the ground to move in a shearing motion perpendicular to the direction of wave movement.

Surface waves can cause rolling motion or sideways movement. These waves result in ground heave and swaying buildings. Surface waves cause the most devastating damage to buildings, bridges, and highways.



The Alpine Fault

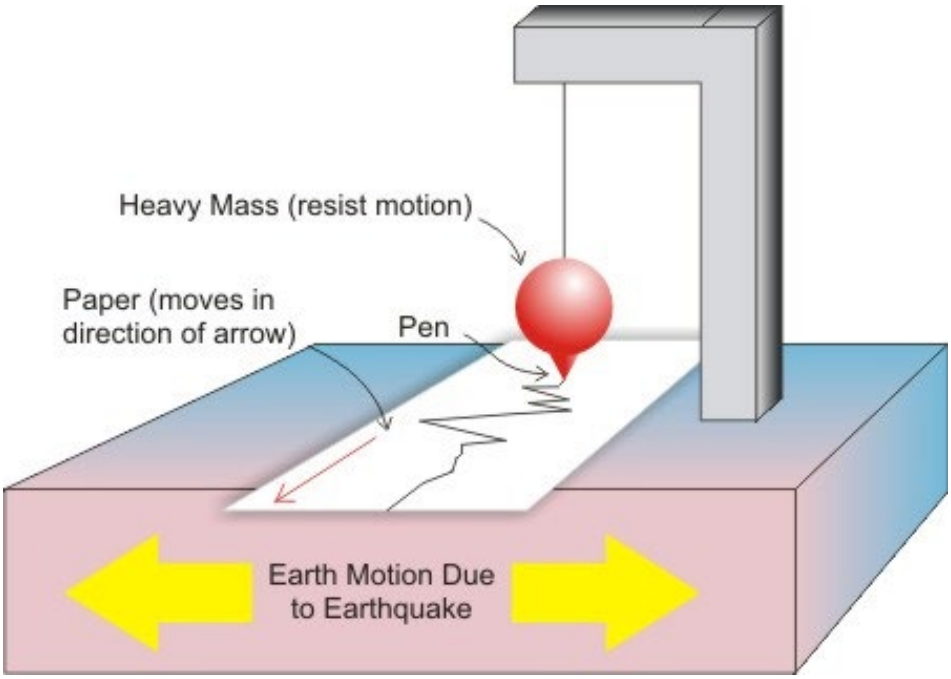
The **Alpine Fault** is about 600km through the middle of the South Island. It's occurs at the boundary of the Pacific and Australian Plates.

Horizontal movement of the Alpine Fault is about **30m** per 1000 years, very fast by global standards.

A new fault line was discovered when the February 22 Earthquake occurred in Christchurch. This was an extension off the Alpine fault and was in the form of a strike slip fault.

Scientists have equipment that allows them measure and predict earthquakes

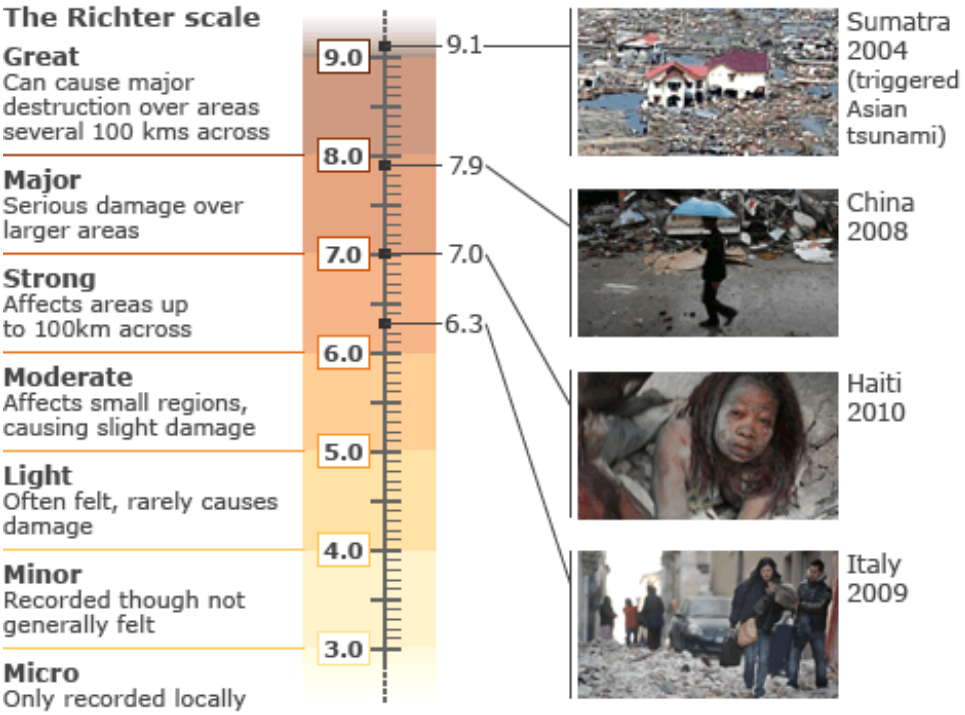
The seismometer is a sensor to detect an earthquake and to measure the **magnitude** of an earthquake. This sensor is made up of a mass that can move relative to the frame of the sensor. Any significant ground motion from an external source will move this frame which is transformed into an electrical voltage that is then recorded on a magnetic tape. Therefore, by using this sensor, the movement of the ground can be measured.



The scientists who study and predict earthquakes are called **seismologists**.

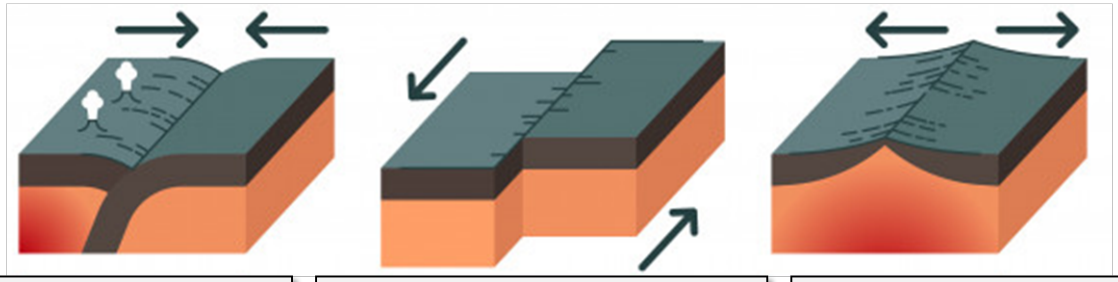
Long term and general predictions about earthquake occurrence can be made by looking at the earthquake history of an area. Scientists look at the records for the last few decades in an area. Such information is useful on a long-term scale but of no help when trying to predict the immediate future.

Accurate short-term predictions are the goal of today's scientists and they use computer technology to constantly monitor and analyse seismic activity. Every year over 150,000 earthquakes are recorded world-wide with as much detail as possible gathered from the world-wide network of seismometers. Rock stress and animal behaviour are also methods used to predict earthquakes.



The Richter scale is used to compare and measure the relative strength of earthquakes. The scale is **logarithmic** which means that each whole number is ten times greater than the one before i.e. an earthquake of magnitude 7 is 100 x greater than one of 5

1. Label the three different types of plate boundary and give details on how each type occurs.



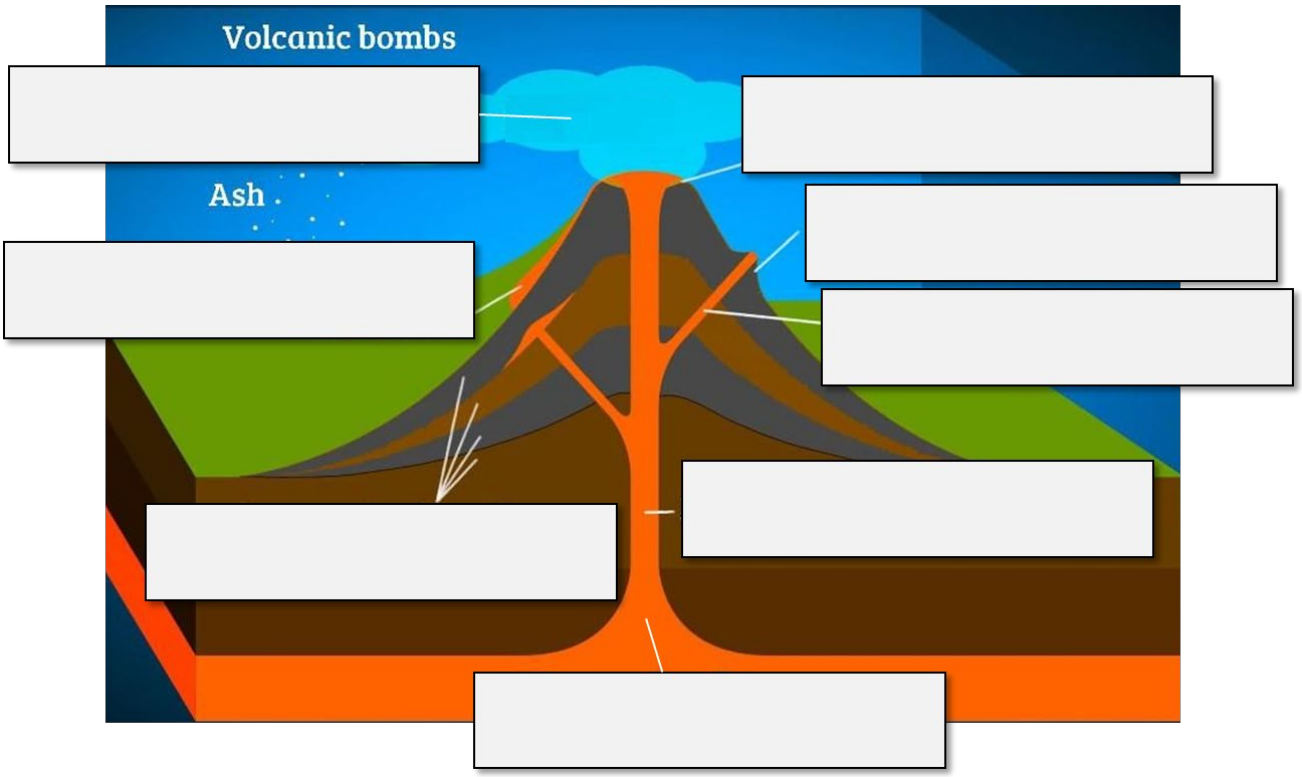
This occurs when

This occurs when

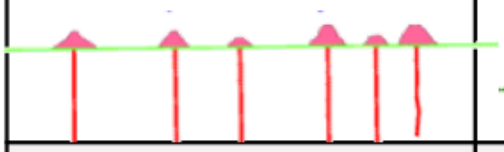
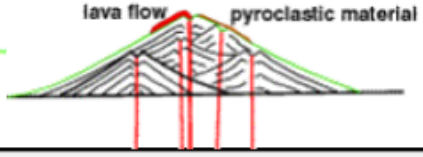
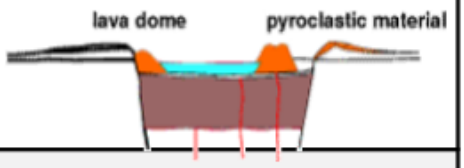
This occurs when

2. Label the different structures in a volcano

Magma chamber	crater	ash cloud	main vent	layers of ash and lava	lava flow	secondary vent	secondary cone

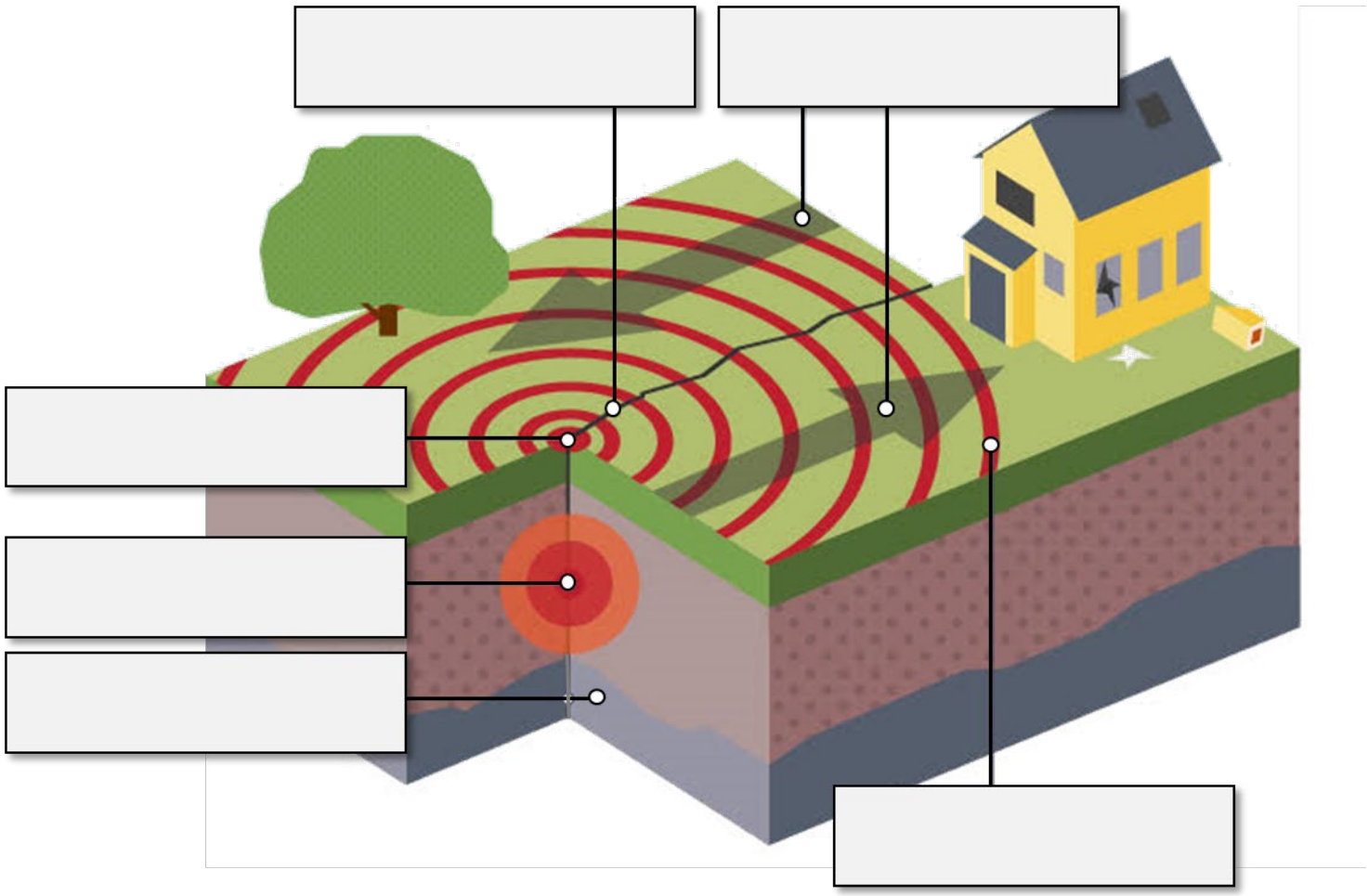


3. List New Zealand examples of the main types of volcanos found here. You may need to research to find more.

Volcanic Field	Cone Volcano	Caldera Volcano
		
Examples	Examples	Examples

4. Label the main features of an earthquake

plate movement	seismic waves	focus	epicentre	Faultline	crust



5. Research time! Find valid sources to give examples of past earthquakes along the **Richter scale.** Give locations, dates and any other relevant information. New Zealand examples should be included.