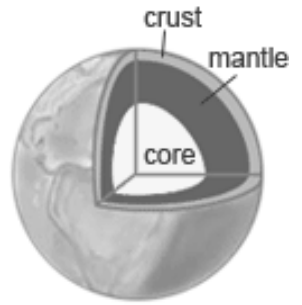
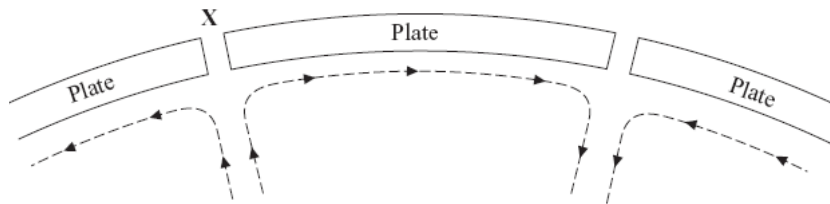


Earth Science

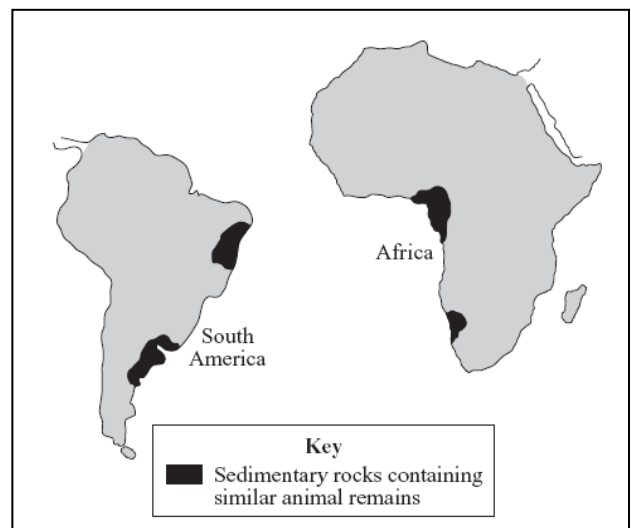
- ❑ Structure of the Earth: crust, mantle and core. The earth is made up of four layers. The crust is relatively thin and ranges from 6 to 40 km in thickness and is divided into 'plates' which 'float' and move on the mantle. About two-thirds of the Earth's surface is water. The mantle is about 3000 km deep and is a very hot rock material, almost solid. It moves very slowly due to huge convection currents, created by heat in the Earth's core. The melted rock is called magma and it comes up to the surface in volcanic eruptions. The core is composed mainly of iron and other metals and has a diameter of about 3500 km. It is very, very hot and dense. The core actually has an outer layer (liquid) and an inner layer (solid). The iron core creates the Earth's magnetic field.



- ❑ Plate tectonics is a theory that the earth's crust is made up of plates, which move relative to one another. The Earth's lithosphere (the crust and the upper part of the mantle) is cracked into a number of large pieces (tectonic plates) which are constantly moving at relative speeds of a few centimetres per year as a result of convection currents within the Earth's mantle driven by heat released by natural radioactive processes.



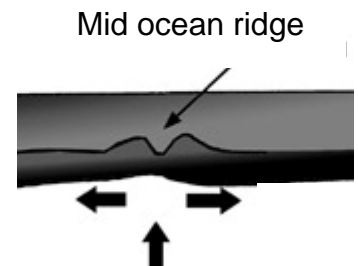
- ❑ Earthquakes and/or volcanic eruptions occur at the boundaries between tectonic plates. The plates meet at a plate boundary. There is earthquake activity, bands of volcanoes eg the 'Ring of Fire', more recently formed mountain ranges, and deep ocean trenches or mid-ocean ridges.
- ❑ Continental drift. Plate movements have occurred on a large scale over millions of years. Land masses which were once joined as "super-continents" have moved apart. Pangaea (400 million years ago) split into Laurasia and Gondwanaland. New Zealand then split off Gondwanaland. Evidence for this includes several continent shapes seeming "to fit into each" other like jigsaw pieces eg South America and Africa. Different continents have similar mountain ranges made of the same aged rock which are now geographically far apart. Some fossils found in South America and Africa are very similar. This suggests that the tectonic plates on which South America and Africa lie have moved apart. Some animals on different continents appear to have a common ancestor eg the emu, ostrich and moa, and the llama of South America and the camel found in Africa.



- ❑ **New Zealand** lies at the edge of both the Australian and Pacific tectonic plates. New Zealand is greatly affected by its position on the edge of two tectonic plates.
- ❑ Plate boundaries occur where two plates meet each other. Earthquakes and volcanoes may result when the plates interact. Plates under land masses are called continental plates. Plates under the ocean are called oceanic plates. Plates may do one of three things at plate boundaries: slide past each other, separate or collide.

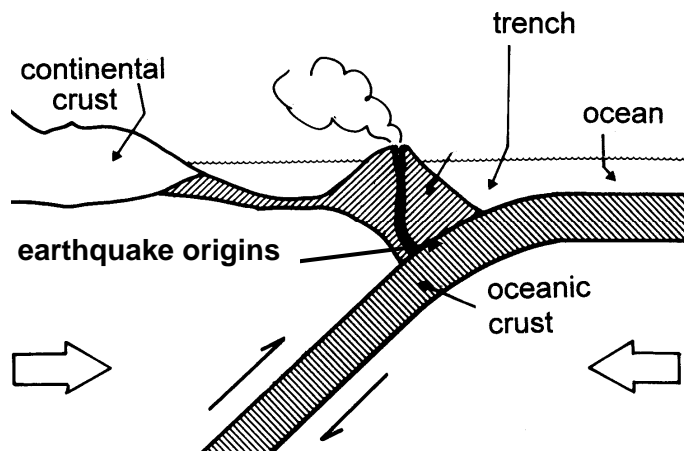
- Slide: Plates can pass each other sideways and the 'grinding action' means that tension builds up in the rocks either side of the fault line. The plates do not slide past each other smoothly but get stuck at the boundary where there is a lot of friction. As they try to slide very large forces build up. Eventually the forces are great enough to overcome the friction and one plate moves rapidly against the other. The rock layers move suddenly and unpredictably causing an earthquake.

- Separate: Plates move apart due to convection currents within the earth. A mid-ocean ridge is formed when hot magma rises through the upper mantle in the ocean at plate boundaries. The magma cools rapidly in the cold sea water, forming underwater mountains. Eg the Mid-Atlantic ridge. The process is also called sea floor spreading. Hot magma may sometimes burst violently out of a mid-ocean ridge from underwater volcanoes. Earthquakes and volcanoes under the ocean can cause "tsunami" which can do great damage when they reach land.



- Collide: When the thinner and denser oceanic plate collides with the continental plate, the oceanic plate is forced down into the mantle. The oceanic plate is said to be subducted.

The enormous pressures cause rocks to melt and new magma is formed. This magma is under pressure and may burst out of a volcano. The continental plate is crumpled and folded, giving rise to mountain ranges (known as Fold mountains). Eg The Andes on the west coast of South America. An ocean trench is formed offshore where the oceanic plate is forced downwards at the subduction zone. Earthquakes may also occur because of plate movement.



- Two continental plates may also collide, building huge mountain ranges like the Himalayas, created by the massive collision and compression. The Himalayas are where the Indo-Australian Plate is colliding with the Eurasian Plate.

- ❑ Rock layers under intense pressure can bend slowly to form folds or break suddenly to form faults. Folding shows the compression of layers due to plate tectonic movement as plates meet. A downward curve of rock is called a syncline, an upwards curve is called an anticline. Fault lines are immense 'cracks' down through layers of rocks, caused by earthquake activity. In future earthquakes the rock movement often happens along these fault lines.

- ❑ Earthquakes produce P and S waves. Seismographs detect these waves. The results on a seismogram are used to detect the position of the epicentre. The focus is where earthquake occurs and epicentre is the point at earth's surface above the focus.
- ❑ Mercalli and Richter scales. Earthquake power can be measured on these two scales: The Richter Scale is based on shock wave acceleration and energy. It is a "log scale", which means that an increase in 1 unit means 10 times more powerful. Eg an earthquake of magnitude 6 is 1000 x more powerful than one of magnitude 3 on the Richter scale. The Mercalli Scale is based on a succession of increasingly 'dramatic' observed events from the lowest, I – "People do not feel any Earth movement", to XII – "Almost everything is destroyed. Objects are thrown into the air. The ground moves in waves or ripples. Large amounts of rock may move".
- ❑ There are three types of rocks, igneous, sedimentary and metamorphic. Sedimentary rocks - layers of rock fragments that were compressed and cemented together. They often contain fossils. Igneous rocks - molten rock that cooled and solidified. They do not contain fossils. Metamorphic rocks - existing rocks that are compressed and heated without melting. The Earth's crust is constantly changing, and the term 'rock cycle' refers to the constant recycling of material in the crust
- ❑ Volcanoes tend to form where plates meet. The crust and mantle are disturbed in the subduction zone and extra heat is generated from compression and friction. Hot magma working its way upwards and breaks through as a volcano. The rapid release of high pressure gas trapped in the magma can throw out huge quantities of magma, rocks and volcanic ash in an eruption.
- ❑ Weathering is the slow breaking down of rocks into smaller and smaller fragments and it can occur in many different ways. (i) physical weathering e.g. water freezes in rock cracks, and expands as it turns to ice which cracks the rocks apart; continuous battering of rock surfaces with dust and sand particles by the wind; waves crashing on cliffs; rocks expanding and contracting with extreme temperature changes causing bits to break off; glaciers grinding rock material as they slowly move. As water transports rocks they become ground down into smaller and rounder particles. (ii) chemical weathering eg acid rain water will gradually break up rocks. Rain is acidic due to dissolved carbon dioxide, pollution from burning fossil fuels and sulfur dioxide from fossil fuels and volcanic activity. (iii) biological weathering eg growing plant roots expanding in the cracks of rocks and put them under pressure.
- ❑ Erosion is the wearing away of the rock. Transportation is the eroded weathered rock fragments being moved away. They mainly 'fall under gravity' and then the fragments carried away by streams and rivers water as well as by wind.

Useful Internet link:

<http://www.wpbschoolhouse.btinternet.co.uk/page21/GeoChangesANS.htm>