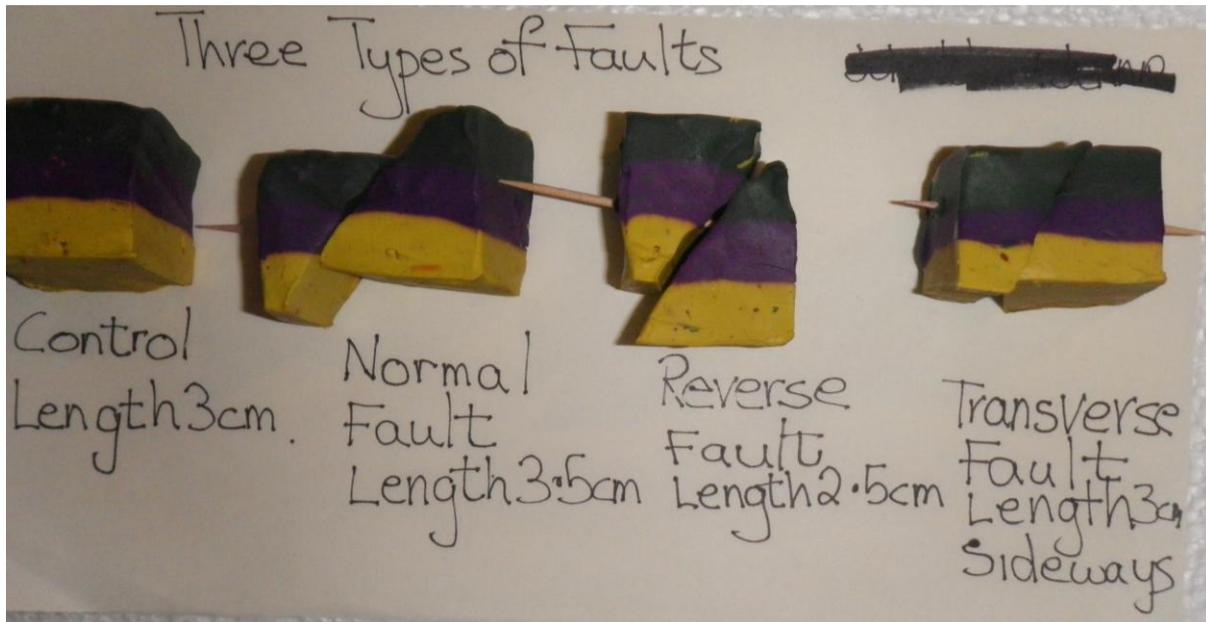


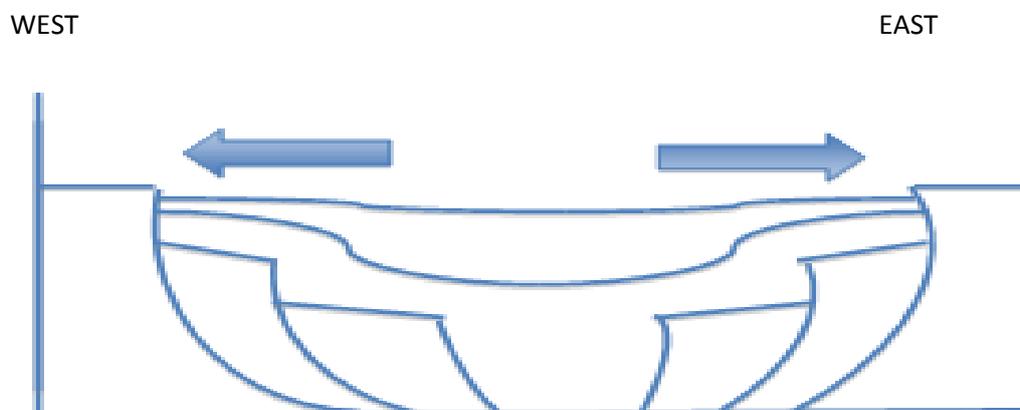
Three Types of Fault - Teacher Notes



Faults are breaks in rock where one side is displaced relative to the other. Fault displacements can be on any scale from millimetres to kilometres to hundreds of kilometres. Friction along fault surfaces causes strain to build up and be released as earthquakes. Stress causing fault movement is greatest along continental plate margins. The Indo-Australian plate moves northward relative to the Eurasian plate at about 10mm per year. Earthquakes are frequent and severe. Luckily Australia lies away from the margins of its plate.

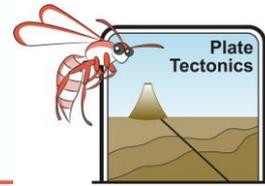
1. Normal Fault - Extension of Crust

Where the crust is being stretched or extended "normal" faults occur. During ancient geological times Australia, India, Africa, New Zealand and Antarctica were welded together to form the supercontinent of Gondwanaland. About 184 million years ago the supercontinent began to break up and the present continental plates started to move apart. Continental crust between the separating plates was stretched thin and was split by a series of faults. The stretched crust then sagged to create a marine sedimentary basin bounded by fault block ranges. The diagram below is a section through the Earth.



Crust sags downward in a normal fault.

Three Types of Fault - Teacher Notes



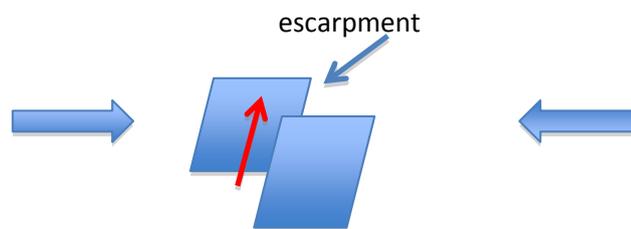
This sag can be demonstrated by stretching some warm silly putty or play dough. The Darling Scarp, which runs north to south near the coast of Western, Australia is a normal fault, which has been activated and reactivated over more than a billion years. The down-faulted western side has more than 15km of sediments laid down in it and the Indian Ocean fills the sagging central portion. The African Rift Valley crust is presently being stretched east to west this has resulted in north to south aligned normal faults on either side.



2. Reverse Fault - Compression

Where the crust is being compacted blocks slip over and under each other. If the fault lies between 0 and 20° it can be called a thrust fault but over that it is called a reverse fault. Blocks are pushed over each other or raised upwards to form small escarpments.

Reverse fault



Meckering is a small town on the Great Eastern Highway between Northam and Cunderdin. In 1968 it was struck by a major earthquake of magnitude 6.9 in 1968. Thrust faults over 17km long could be seen as ridges up to 2m tall running across farmland. The ridges have since disappeared due to weathering. Major thrust zones occur where the Australian continental plate is riding up over the Pacific plate.

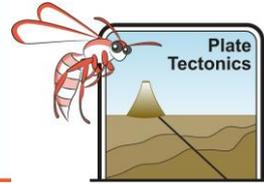
3. Transform Faults - Lateral Movement

Where the movement is mostly horizontal and one block slips alongside another, transform faults occur. The San Andreas Fault on the western coast of the USA is such a fault. The Pacific Plate is moving at a different speed to the North American Plate causing increasing horizontal displacement.

Normal faults result in extension of the crust E.g. Darling Fault
Reverse faults result in contraction of the crust E.g. Meckering Fault
Where the crust is being sheared and blocks move laterally, transform faults occur. E.g. San Andreas Fault and Christchurch Fault

Faults can be reactivated over millions of years with quiet periods between. Repeated extension and compressional movements are critical to understanding hydrocarbon migration potential and fault trap creation of the oil and gas fields in the North West Shelf and gold mineralisation in the Kalgoorlie Boulder area.

Three Types of Fault - Teacher Notes



Student understanding and ability to remember different fault types can be enhanced by concrete operational activities. They will be able to see the 3D expression of faults at hand. Coloured layered polystyrene or plasticine blocks are excellent for this purpose. Polystyrene blocks are best cut and painted in layers in advance. Computer packaging often has textural layered bands already.

If the plasticine is to be separated and used again afterwards it is wise to dust the interfaces with talcum powder. Multi layer sandwiches are also excellent but must be prepared out of the science laboratory if they are to be eaten later.



Materials per student or group

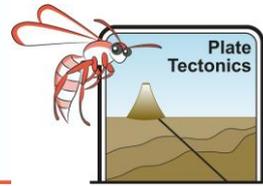
- Four polystyrene blocks the same size (6cm by 5cm by 4cm is good) Polystyrene is commonly used for packing computers and other electronic equipment.
- Three different colours of PVA paint (old house paint is good)
- Brushes
- Jam jar or beaker with water for the paint brushes
- Old newspaper
- Stanley or other reasonably sharp knife. Safety rules!
- Toothpicks



Method:

1. Lay down the newspaper to protect the bench.
2. Paint three layers of different colours onto each block to represent three layers of sedimentary rock.
3. Leave to dry.
4. You have a model of four piles of sedimentary rock.

OR



Three Types of Fault - Teacher Notes



Materials per student or group

- Three lots of different coloured plasticine
- A knife
- Old newspaper

Method:

1. Lay down the newspaper to protect the bench.
2. Divide the plasticine into four and flatten it to a thick square by squeezing between thumb and forefinger.
3. Layer the plasticine to represent sedimentary rock and cut into four equal sized pieces.
4. You have a model of four piles of sedimentary rock.

We wanted to demonstrate three different fault types. Why have we got four specimens? **One is the CONTROL** against which any change can be measured. The others are the experimental models.

Which form of fault resulted in contraction (shortening) of the crust? Please include your primary data to support your theory. **The reverse fault results in contraction of the crust. The horizontal length has decreased from _____ to _____.**

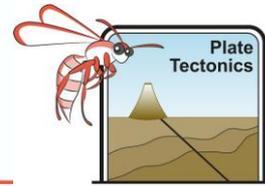
Which form of fault resulted in extension of the crust? Please include your primary data to support your theory. **The normal fault results in extension of the crust. The horizontal length will have increased from _____ to _____.**

Which form of fault resulted in horizontal relocation of the crust? Please include your primary data to support your theory. **The transform fault results in horizontal relocation of the crust. Blocks have been displaced by _____**

Miners and geologists call the plane of movement “the wall”. The upper side is known as the “hanging wall” because it hangs above you when you are underground. For similar reasons the lower wall is known as the “foot wall”. In normal faults the hanging wall moves upwards whilst in reverse faults it moves downwards.

Faults are very important in mining as they can provide paths for mineralisation but they can also cut off and displace mineralised beds and veins.

Three Types of Fault - Teacher Notes



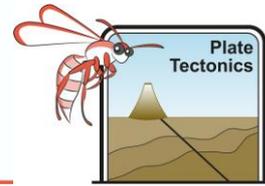
Extension - Finding fault - Use your knowledge

1. Meckering is a small town on the Great Eastern Highway between Northam and Cunderdin in Western Australia. Immediately after the earthquake in 1968 farmers noticed little scarps a few centimeters high running in bands across their fields. It looked like a series of steps that had been pushed up. Which kind of faults would have caused these? Explain your answer. *These were reverse faults as the hanging wall block had moved upwards. The faulting was caused by compression.*
2. In East Africa two major blocks of land are moving apart causing the Great Rift Valley to form between them. Every year it gets wider and wider. What kind of faults would margin this valley? Explain your answer. *These are normal faults because the crust is extending and sagging between them.*
3. When the Cadoux fault reactivated in 1979, farm tracks were displaced sideways and they had to be rebuilt. What kind of faults would have caused this? Explain your answer. *These were transform faults as the line of the track was moved laterally.*

This birthday cake is going to suffer faulting. Sketch what would happen if it was to suffer the three main types of faults we have studied.

Original Cake	Type of fault	Result of faulting
	Reverse fault Compression	
	Normal fault Extension	
	Transform fault Shear	

Three Types of Fault - Teacher Notes



Almost all Australian earthquakes have a component of compression producing uplift. Compression is a major component in the earthquake swarms near Dumbleyung and Hyden.

The Darling Fault, which runs 2,000km north to south in Western Australia, has moved many times. Sometimes the western block has moved up and sometimes down. Faults are rarely single zones moving consistently in one direction.

Three dimensional fault models are good for exhibitions in the school library, entrance or at Science Fairs.

