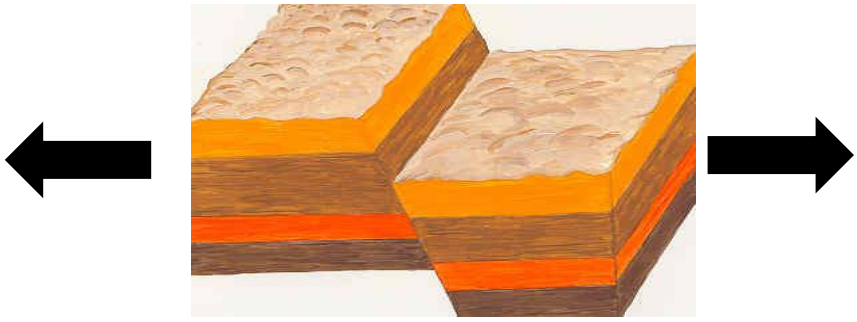
Faults

Lesson 6

Faults are fractures in the crust where there has been a displacement of rocks. The movement of rocks along a fault is parallel to the fracture. Major faults develop where crustal plates meet. Convection currents inside the Earth are the driving forces that cause crustal plates to separate, collide, or slip past each other. Intense heat and pressure from the convection currents places a constant strain on the rocks. The strain on the rocks continues until they rupture creating a fracture in the rocks.

The fracture in the rocks creates a fault and a zone of weakness in the crust. The pressure on the rocks continues after an earthquake and they begin storing energy until the weakened rocks along the fault zone rupture again. Fault movement and earthquakes will continue as long as convection currents inside the Earth create pressure on the rocks. Many unknown faults have not ruptured in historic times. Scientists discover faults with seismographs that detect earthquakes in areas where there is no physical evidence above ground of a fault.



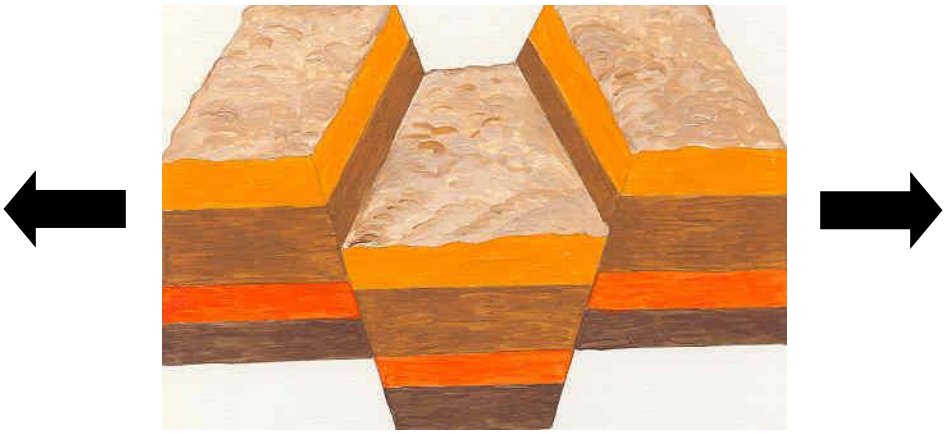
Normal faults develop when crustal plates are separating.
One block of land drops down.

Ninety percent of all earthquakes occur at plate boundaries and are the result of plate movement. Adjoining plates moving at different speeds and directions develop faults. Depending on the heat and pressure plates may move horizontally or vertically in relation to another plate. Two plates can also be moving at different speeds in the same general direction. There are three main groups of faults based on how they move. Normal faults usually develop when crustal plates move apart creating tension on the rocks along spreading ridges. Reverse faults or thrust faults develop when plates are colliding. Most faults that form in subduction zones are thrust faults. Strike-slip faults develop when two plates are moving horizontally.

Normal faults develop in areas where the land is pulling apart or stretching. The tension in the crust increases until the rocks fracture and one block of land slips downward in relation to the block of land on the other side of the fault plane. A normal fault will have a hanging wall and a footwall. The term footwall is derived from miners finding mineral deposits where inactive faults

have been “filled in” with mineral deposits. The hanging wall is the side of the fault above the fault plane where the ore deposit is located.

A reverse fault occurs when two landmasses are compressed and the hanging wall moves upward. This type of fault movement thickens and shortens the crust. Sometimes the fault line allows one block of land to slip over the top of another creating a thrust fault. Normal faults and reverse faults usually move blocks of land upward in steeply inclined planes. The angle that a thrust fault moves over another section of land is less than forty-five degrees. A blind thrust fault occurs in areas where a shallow-dipping reverse fault terminates before it reaches the Earth’s surface. Tension in the crust will cause the rocks to fracture but the fracture does not have any surface features. Many unknown thrust faults are suspected in California. Some faults are not discovered until a major earthquake occurs.

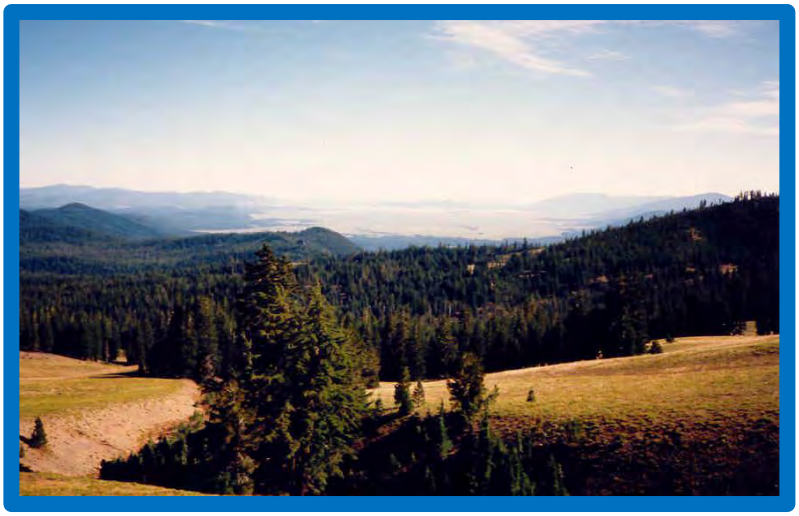


The 3000 km long, East Africa Rift system is a series of grabens. The zone is 50 to 60 kilometers wide.

Major faults do occur in the middle of crustal plates. There are two famous mid-plate boundaries in the United States. The New Madrid Fault in Missouri and the Wasatch Fault in Utah are two faults within plate boundaries. Pressure builds up in the rocks due to stress and heat in the center of the continent causing the ground to stretch and bend out of shape. The rocks store energy as they stretch and bend until the energy is suddenly released. The earthquakes that occur when the rocks fracture are felt everywhere in that region of the country. When a substantial area has a plane of weakness, a fault develops. Additional strain on the rocks continues in the area. Eventually large earthquakes result when the weakened rocks rupture again.

Rocks fracturing in one area may relieve the stress on those rocks but produce increased stress on the rocks further along the fault. The New Madrid earthquake of December 6, 1811 was followed six hours later by a large aftershock. The aftershock was a result of increased pressure on rocks in other parts of the fault zone. Scientists think the continuing aftershocks and two large earthquakes in January and February are the result of rocks adjusting to new pressures created after the December 6 earthquake.

Parallel faults can develop when land is pulling apart. The block of land in-between the two parallel faults drops down creating a valley. Valleys that develop between two parallel faults are grabens. The East Africa Rift System is a 50 to 60 km wide zone of active volcanoes and faults. The faults have created a series of grabens that formed in Eastern Africa. The faulting extends more than 3000 km from Ethiopia in the north to Zambezi in the south. There is an active rift zone in the middle of a continental plate where the grabens developed. The African Plate is in the process of splitting apart and the area where the grabens are located may someday become a new ocean.



The Klamath Basin in the distance is a graben that formed due to stretching and thinning of the crust caused by plate movement.

Horsts are elongated areas that form between parallel faults when forces on either side of a block of land are moving together causing the crust to shorten. Mountains form as the land moves upward between two faults. The Steens Mountain in Oregon is an example of a horst. The Basin-and-Range country in the western part of the United States has a number of tilt-block mountains formed by normal and reverse faults.

The mid-oceanic ridge is the greatest mountain range on Earth. Running right down the middle of the mountain ranges are a series of rift valleys. The rift valleys are located in a fault zone that separates one oceanic crust from another. The lava welling up between the two plates creates new oceanic crust as the older crust moves away from the fault zone.

Lesson summary

- Faults are fractures in the crust where there has been a displacement of rocks.
- Ninety percent of all earthquakes occur at plate boundaries and are the result of plate movement.
- A reverse fault occurs when two landmasses are compressed.
- The New Madrid Fault in Missouri and the Wasatch Fault in Utah are two faults within plate boundaries.
- The East Africa Rift System is a 50 to 60 km wide zone of active volcanoes and faults.

Table of Contents