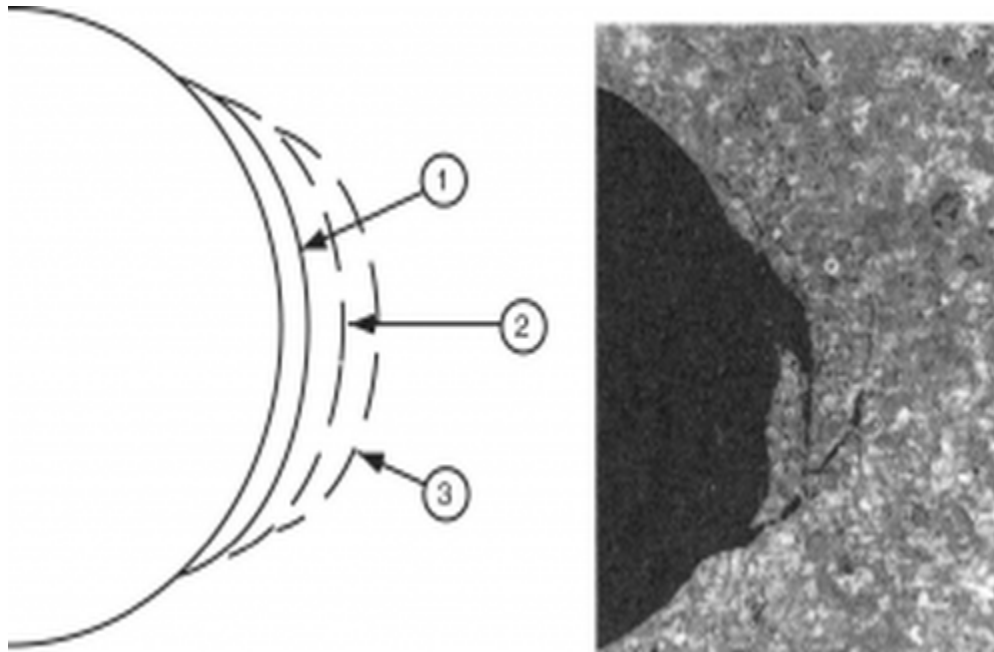


# The tectonic stress field

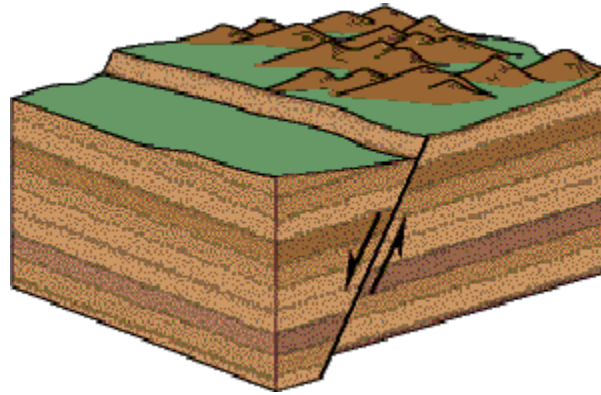
# Why is stress important in petroleum engineering?

**Wellbore failure occurs because the stress around the well exceeds the strength of the rock.**



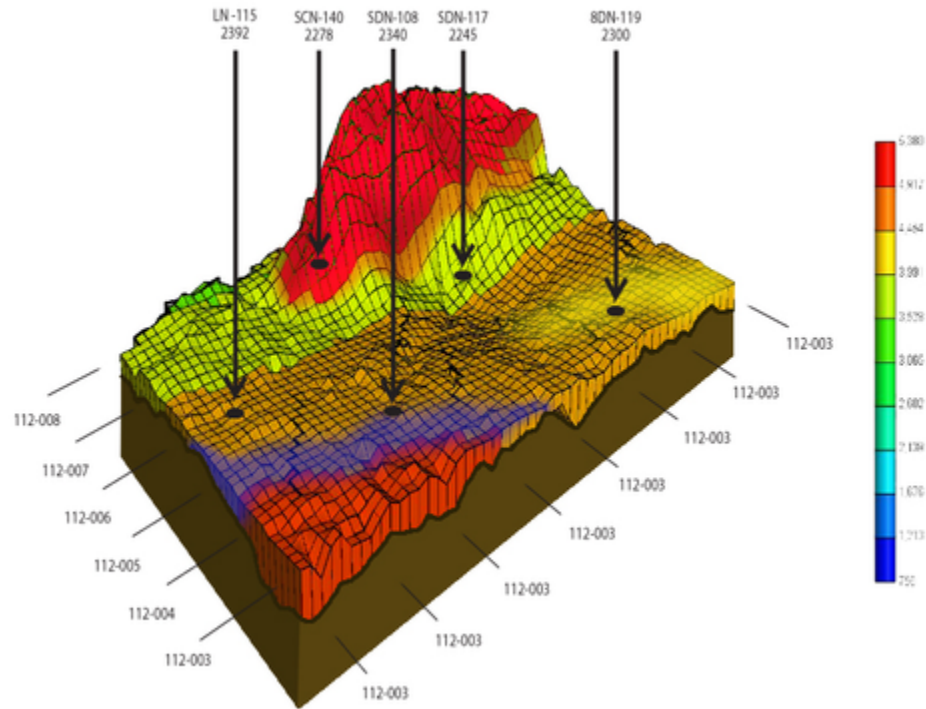
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**Faults will slip when the ratio of shear to normal stress on the fault exceeds its frictional strength.**



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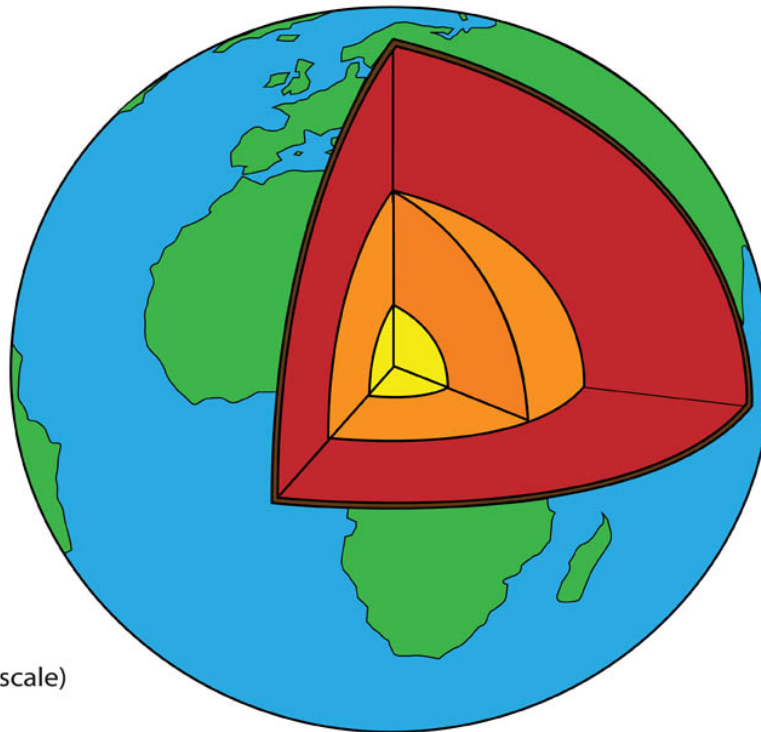
**Reservoir depletion causes changes in the stress state at depth that can be beneficial, or detrimental, to production.**



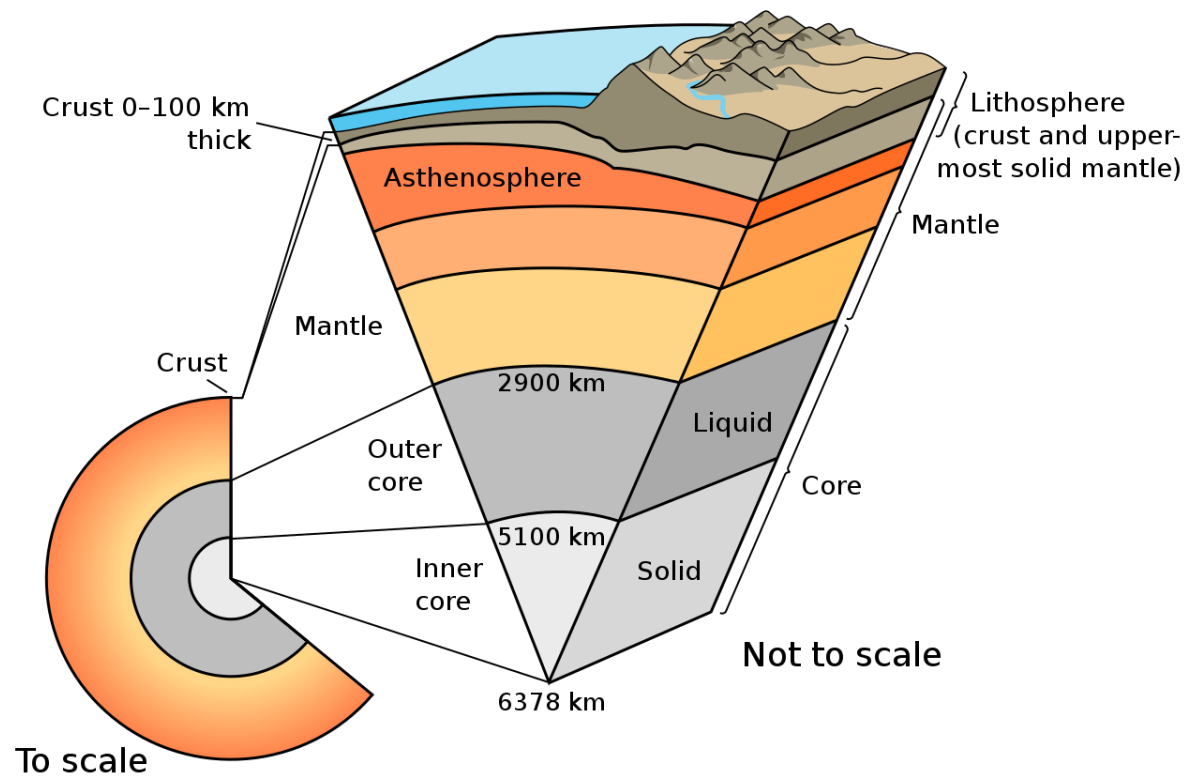
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# The Earth

Earth's Interior



(not to scale)



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# Continental Drift



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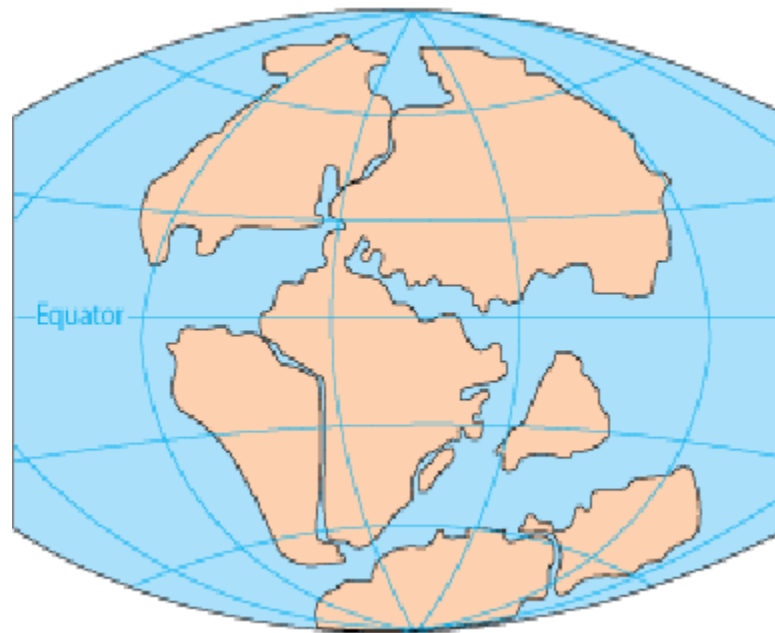
**Permian** -- 250 Million Years Ago





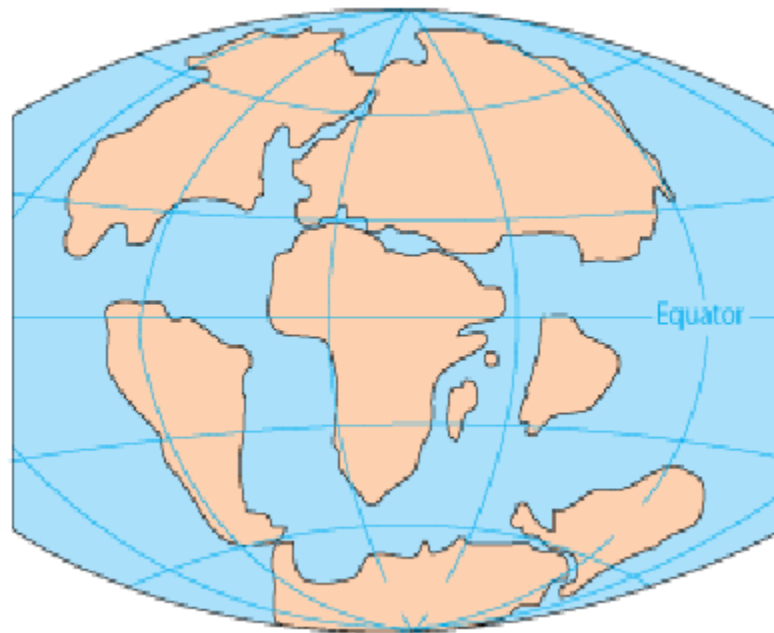
© USGS Image Source

**Triassic** -- 200 Million Years Ago



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**Jurassic** -- 145 Million Years Ago



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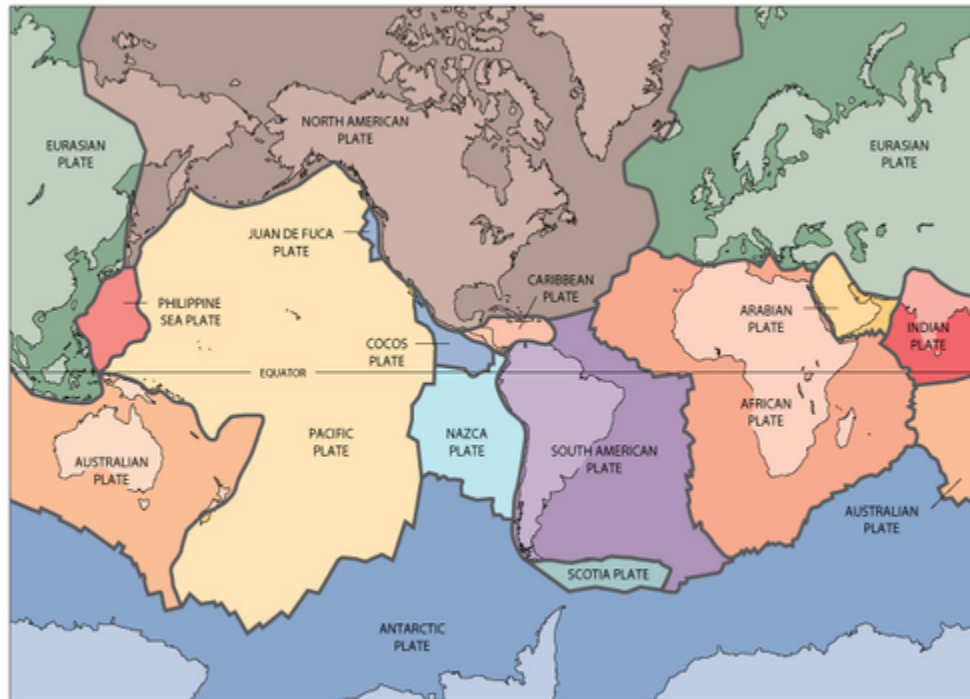
**Cretaceous** -- 65 Million Years Ago



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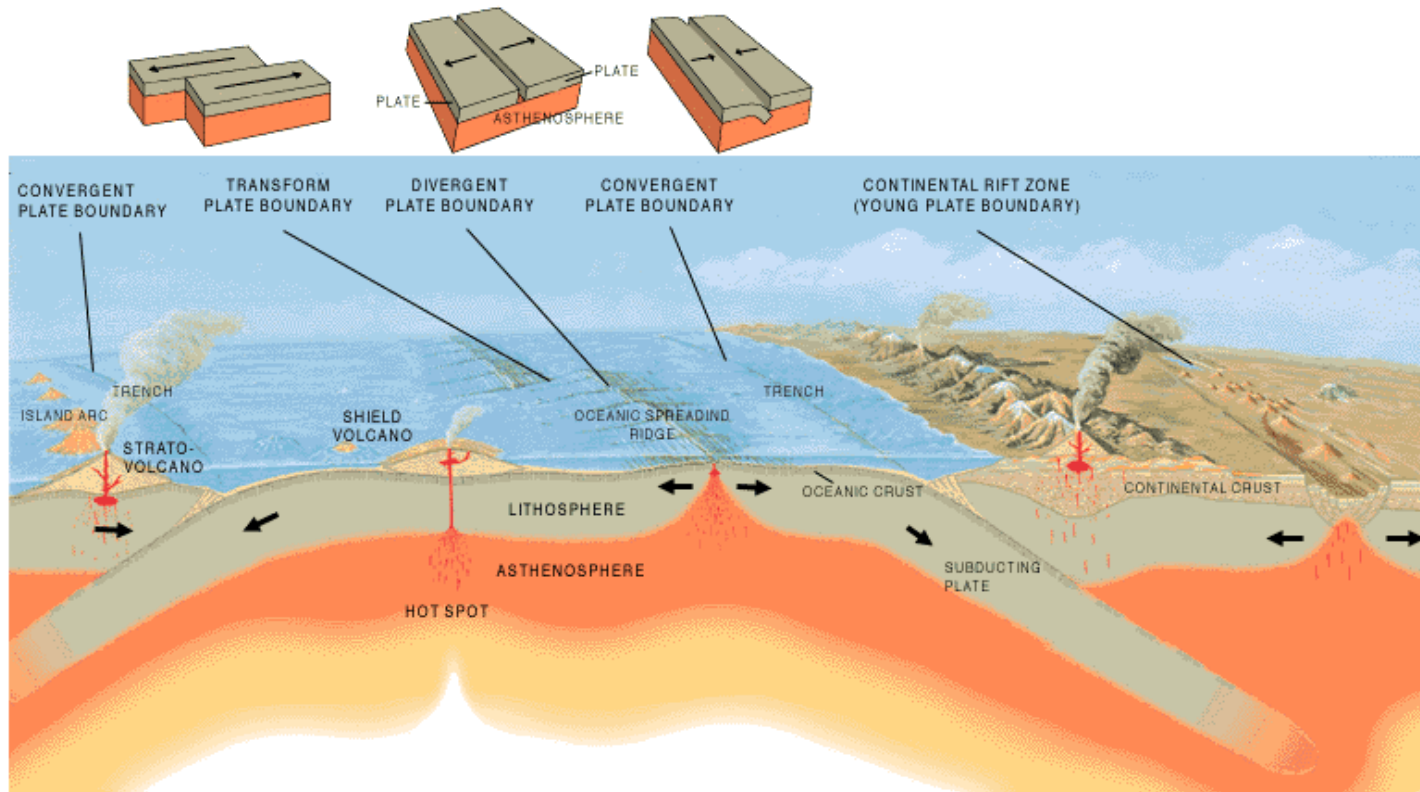
**Present Day**

# Tectonic plates



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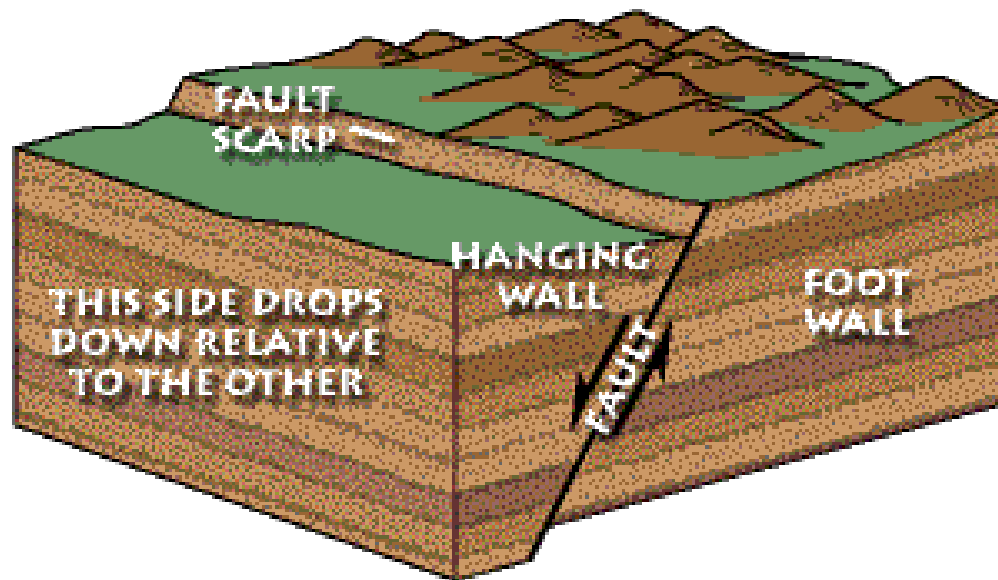
# Plate Boundaries



© USGS Image Source

# Fault types

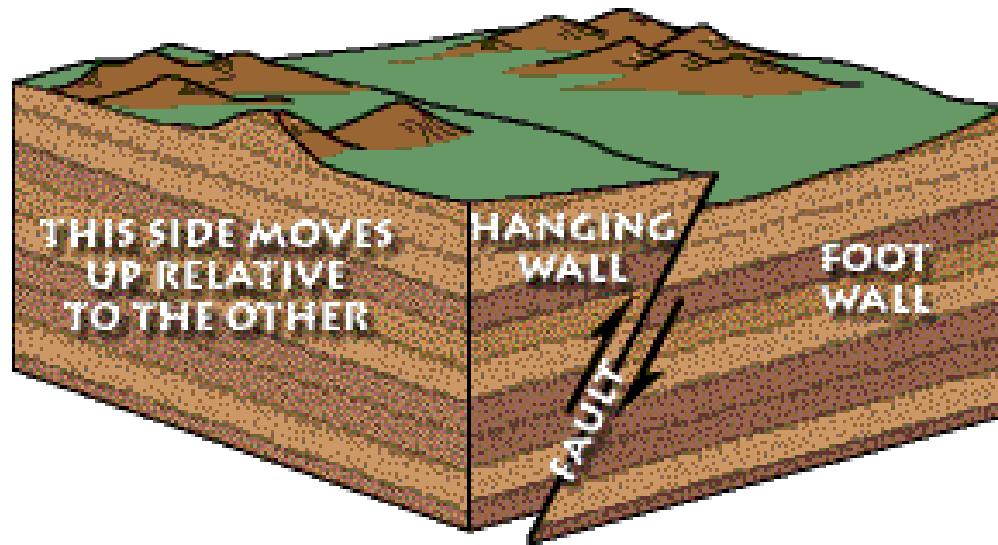
# Normal fault



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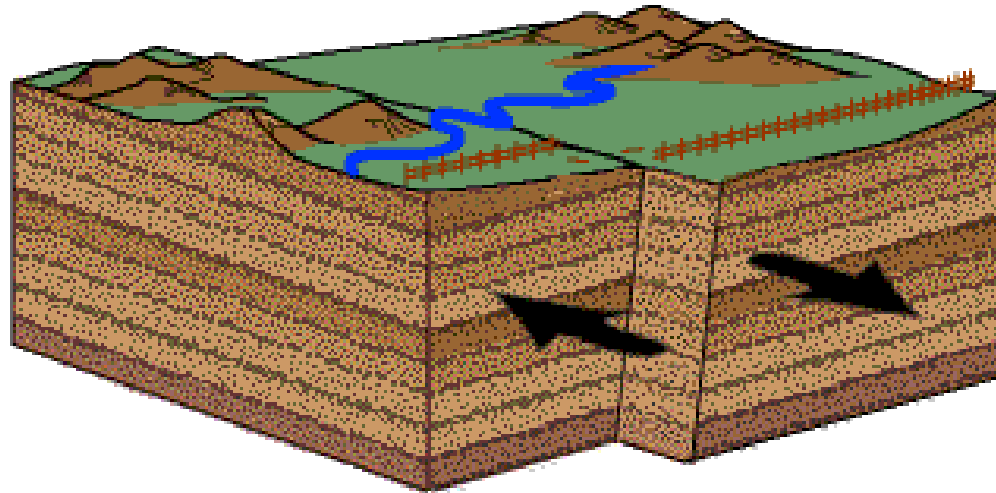


## Reverse fault



© USGS Image Source

# Strike-slip



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# Reality

- Much more complicated!

# Sources of tectonic stress

# Plate driving stresses

- Tectonic plates are pushed by compressional forces from mid-ocean ridges
- Drag forces on the base of the plates
- Frictional resistance to subduction

# Topography and buoyancy forces

- Density anomalies
- Plate thinning
  - extension
- Plate thickening
  - compression

# Plate flexure

- Sediment loading on a tectonic plate
- Wavelength can be as long as 1000km