

## Plate Tectonics

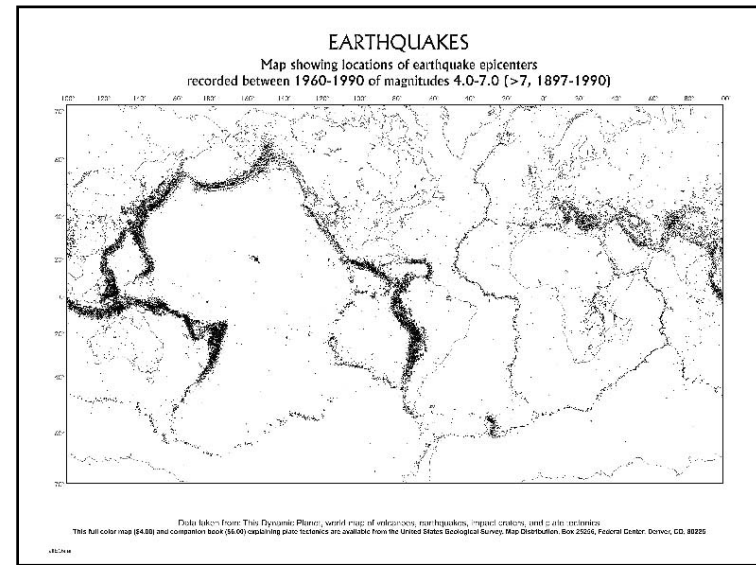
- ◆ Ever notice how S. America and Africa seem to fit together like pieces of a puzzle?
- ◆ As early as the 1500's, mapmakers noticed the striking fit between the shapes of South America and Africa
- ◆ 1596 – a Dutch mapmaker suggests the two continents may have split apart from each other in the past
- ◆ The two continents also have similar fossils and rock formations that helped support the idea

## Plate Tectonics

- ◆ These facts led to a theory first proposed in 1912 by German scientist Alfred Wegener – called “continental drift”
- ◆ Plate tectonics: the earth's crust is broken into plates that move around above the mantle

## Plate Tectonics

- ◆ More evidence for plate tectonics:
  - Earthquakes & Volcanoes
    - ◆ Website of recent earthquakes: <http://earthquake.usgs.gov/eqcenter/recenteqsww/>
    - ◆ A map of the locations of earthquakes shows linear patterns – why?



## Plate Tectonics

- ◆ More evidence for plate tectonics:
  - Seafloor spreading
    - ◆ New crust is forming in the middle of the Atlantic as N. America moves away from Europe (and S. America moves away from Africa)

## Plate Tectonics

- ◆ Map of seafloor spreading in Atlantic

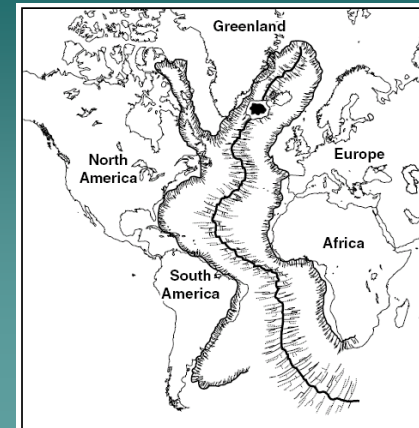


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## Plate Tectonics

- ◆ Plate movement can now be measured with modern technology – satellites (similar to GPS) can accurately measure rates of movement.
- ◆ Typical rates of movement are 2-4cm (about 1 inch) per year.
- ◆ Over LONG periods of time, such as millions of years, this can amount to HUGE distances.
- ◆ Example: If a plate moved at 2cm per year for 200 million years:

$$200,000,000 \text{ years} \left( \frac{2 \text{ cm}}{\text{year}} \right) = 400,000,000 \text{ cm or } 4,000 \text{ km}$$

- ◆ This is 4,000km or 2,500 miles!!!! (the distance from Minneapolis to San Jose, Costa Rica!)

## Plate Tectonics



## Plate Tectonics

- ◆ The rigid plates on the earth's surface (the lithosphere) move due to convection currents in the mantle

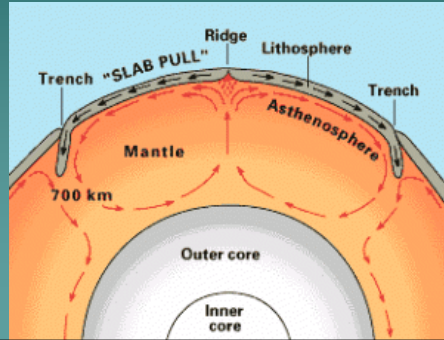


Image credit:  
<http://www.mysciencebox.org>

## Plate Tectonics

- ◆ Plates can be pulled apart (forms ridge) or
- ◆ Plates can be pulled into the mantle (subduction)
- ◆ What surface features are formed at each of the above? Where on earth?

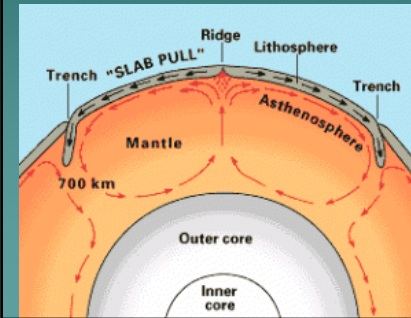
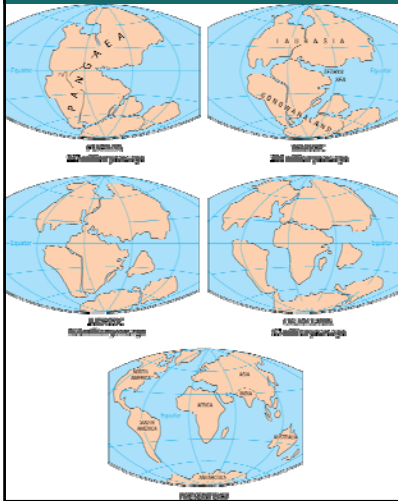


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<http://www.mysciencebox.org>

## Earth's Past and Plate Tectonics



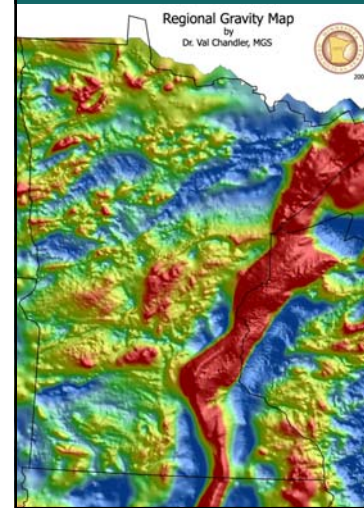
For reference – the dinosaurs lived during the Triassic, Jurassic, and Cretaceous (they died out at the very end of the Cretaceous)

Image credit:  
<http://pubs.usgs.gov/gip/dynamic/historical.html>

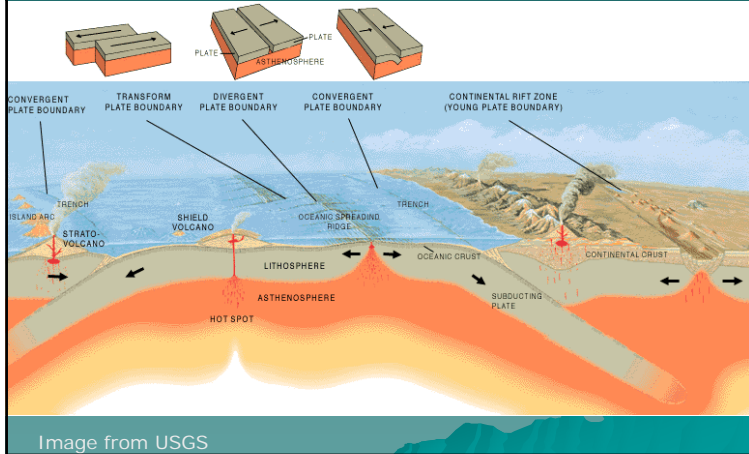
## Minnesota's Rift

Plate Tectonics in MN!

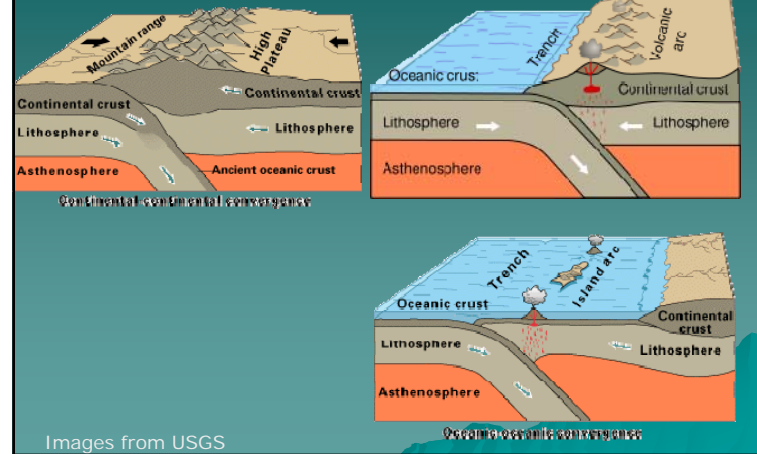
- This is a gravity map – denser rocks show up as red
- The red band on the east side of MN is a stretch of igneous rocks – it stretches all the way to Kansas
- This was where the N. American continent started splitting about 1 billion years ago
- As the continent split, magma seeped up and formed lava flows – yes, in MN!



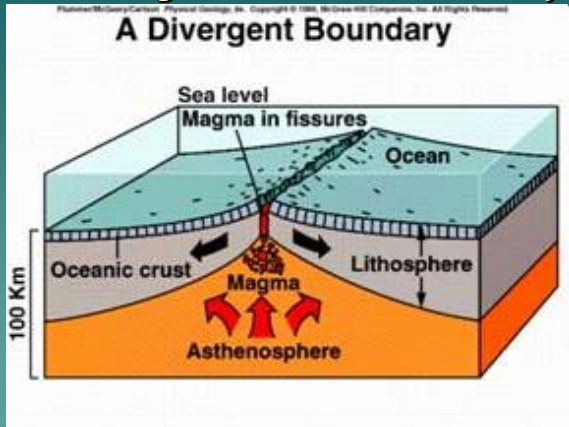
# Plate Boundary Types



# Convergent Plate Boundaries



# Divergent Plate Boundary



[http://dl.coastline.edu/classes/telecourses/geology100/IntroLecture\\_files/image005.jpg](http://dl.coastline.edu/classes/telecourses/geology100/IntroLecture_files/image005.jpg)

# Summary of Plate Boundaries

Type of Boundary	Process	Features	Examples
Divergent ← →	Sea-floor spreading	<ul style="list-style-type: none"> <li>Mid-ocean ridges</li> <li>Rift valleys</li> <li>Earthquakes</li> <li>Volcanoes/lava flow</li> </ul>	<ul style="list-style-type: none"> <li>Mid-Atlantic ridge</li> <li>East-Pacific Rise</li> </ul>
Convergent → ←	Oceanic-oceanic (subduction)	<ul style="list-style-type: none"> <li>Earthquakes</li> <li>Volcanoes (Island arc)</li> <li>Deep sea trenches</li> </ul>	<ul style="list-style-type: none"> <li>Islands of Indonesia</li> <li>Aleutian Islands</li> </ul>
	Oceanic-continental (subduction)	<ul style="list-style-type: none"> <li>Earthquakes</li> <li>Volcanoes along coast of continent</li> <li>Deep sea trenches</li> </ul>	<ul style="list-style-type: none"> <li>West coast of South America (Andes)</li> </ul>
	Continental-continental	<ul style="list-style-type: none"> <li>Earthquakes</li> <li>High mountain chain</li> </ul>	<ul style="list-style-type: none"> <li>Himalayas</li> </ul>
Transform → ←	Plates slide past each other	Earthquakes	<ul style="list-style-type: none"> <li>San Andreas fault (Southern California)</li> </ul>

Modified from McDougal Littell Earth Science textbook page 179