The Earth

Motions Within

Heat-stirred Interior
- Heat stirs up the interior, causing convection
- Convection – occurs when heated material
  - Becomes less dense
  - Rises
  - Brings up heat
- Effects of these interior motions...
  - Earthquakes
  - Volcanoes
  - Magnetic Field

Plate Tectonics, History
- Used to be called Continental Drift
- The jigsaw puzzle-like fit of continental boundaries
  - Abraham Ortelius (1596)
  - Antonio Snider-Pellegrini (1858)
  - Similarity of fossils around matching parts of Africa and South America; F B Taylor (1910)
  - Alfred Wegener (1912)
  - Proposed that modern continents formed from a single super-continent - Pangea
Plate Tectonics, The Evidence

- Convincing evidence in the mid-1950’s – discovery of the mid-Atlantic Ridge
- Age of under-sea rocks correlates with their distance from the ridge
- Youngest rocks are nearest the ridge
- Rocks on either side are older
- The farther they are, the older
  - 100 km away - 10 million years

Plate Tectonics, The Phenomenon

- Upwelling material spreads outwards at a rift such as the mid-Atlantic ridge
- Carries crustal plates with it as it flows outwards
- Creates new crustal rock as it solidifies
- Collision of plates buckles crust—creates mountain ranges: the Himalayas resulting from the Indian plate colliding with the Asian plate
Plate Tectonics, Continued

- Plate motion triggers volcanic eruptions and seismic activity along some plate edges
  - The Pacific rim of fire
- Plates that move sideways against each other can stick to each other for long times
  - Example: the San Andreas Fault between the North American and the Juan de Fuca plates
- Stresses build up at the fault until they are released in a lurching motion of the plates

![Subduction (Plate Motion) Diagram]

![Plates on Earth Map]
Magnetic Fields

- Magnetic fields exist in space surrounding any magnet.
- All magnetism results from electric currents (flows of electrically charged particles).
- Permanent magnets have microscopic currents in the atoms of elements like Iron, Nickel, Cobalt, and Manganese.

Earth’s Magnetic Field

- Rotation and convection in liquid iron/nickel core probably generate Earth’s magnetic field.
- Earth’s magnetic poles are close to (not coincident with) the rotational poles.
- Earth’s magnetic field reverses direction approximately every 10,000 years.
- Reason for reversal not sufficiently well understood, but its existence is “documented” in rocks that formed in different ages.
Earth’s Magnetic Field,  *Continued*

- Magnetic field shields us from the flow of charged particles from the Sun (the solar wind)
- Channels charged particles towards the polar regions
- Fast-moving electrons (guided by lines of magnetic field) excite atoms of atmospheric gases (Oxygen and Nitrogen) in upper atmosphere — leads to **auroras**