General Geology

Geology is the scientific study of the Earth.

The meaning of Geology is: Geo = Earth and logy = Science

General Geology is the study of Earth's materials, changes of the surface and interior of the Earth, and the forces that cause those changes. It is also called Physical geology.

Important of the Earth Study

We're part of it. Humans have the capability to make rapid changes. All construction from houses to roads to dams are effected by the Earth, and thus require some geologic knowledge. All life depends on the Earth for food and nourishment.

Practical Aspects of Geology:

- Natural resources:

  ore minerals, coal and petroleum resources.



- Geological hazards:

  Earthquakes, Volcanoes, Landslides and floods.



- Environmental protection




The Origin of the Solar System

Solar Nebula Hypothesis (Big Bang)

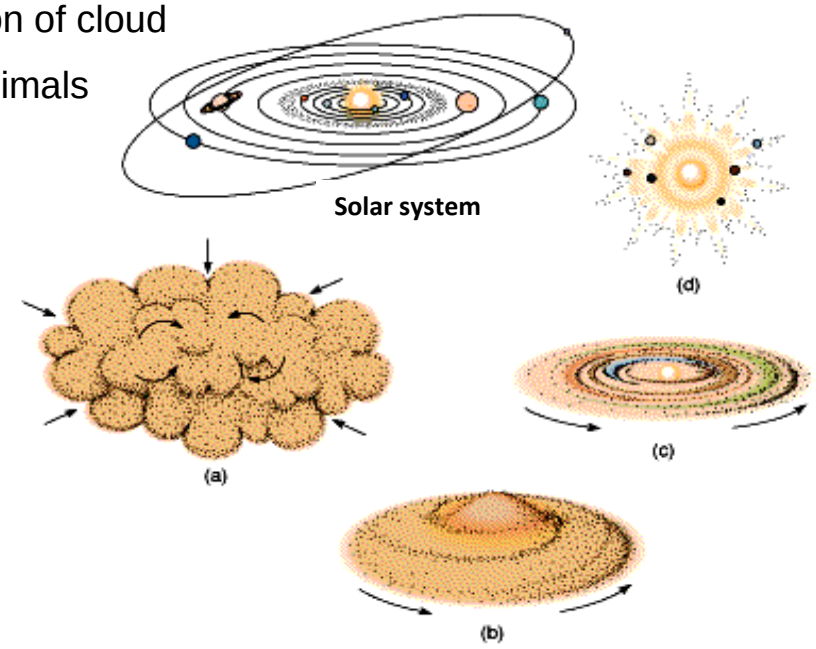
We start at the beginning of the Universe, when, about 13.6 billion years ago, the Big Bang created the universe from a point source.

a) Condensation and collapse of interstellar material

b) Flattening and rotation of cloud

c) Accretion of planetesimals

d) Birth of Sun



Earth system

Earth system consists of four spheres.

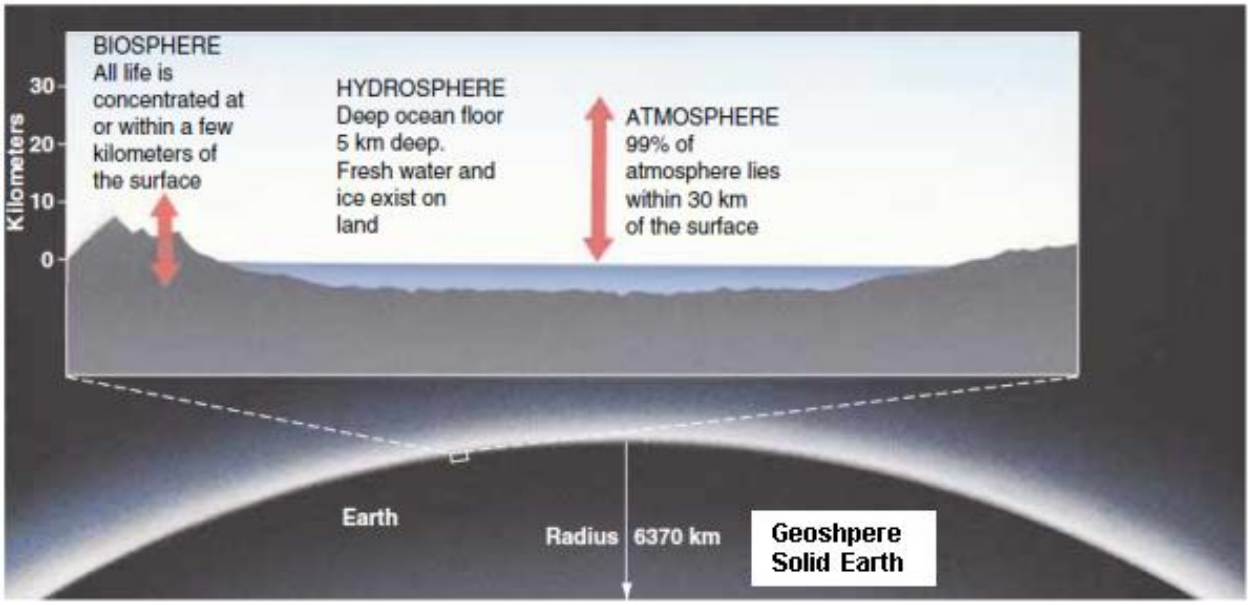
Earth's Spheres

Atmosphere: the gases that envelop the Earth

Hydrosphere *(rivers, ocean, glaciers, lakes):* water on or near the Earth's surface

Biosphere: all living or once-living materials

Geosphere: the solid rocky Earth



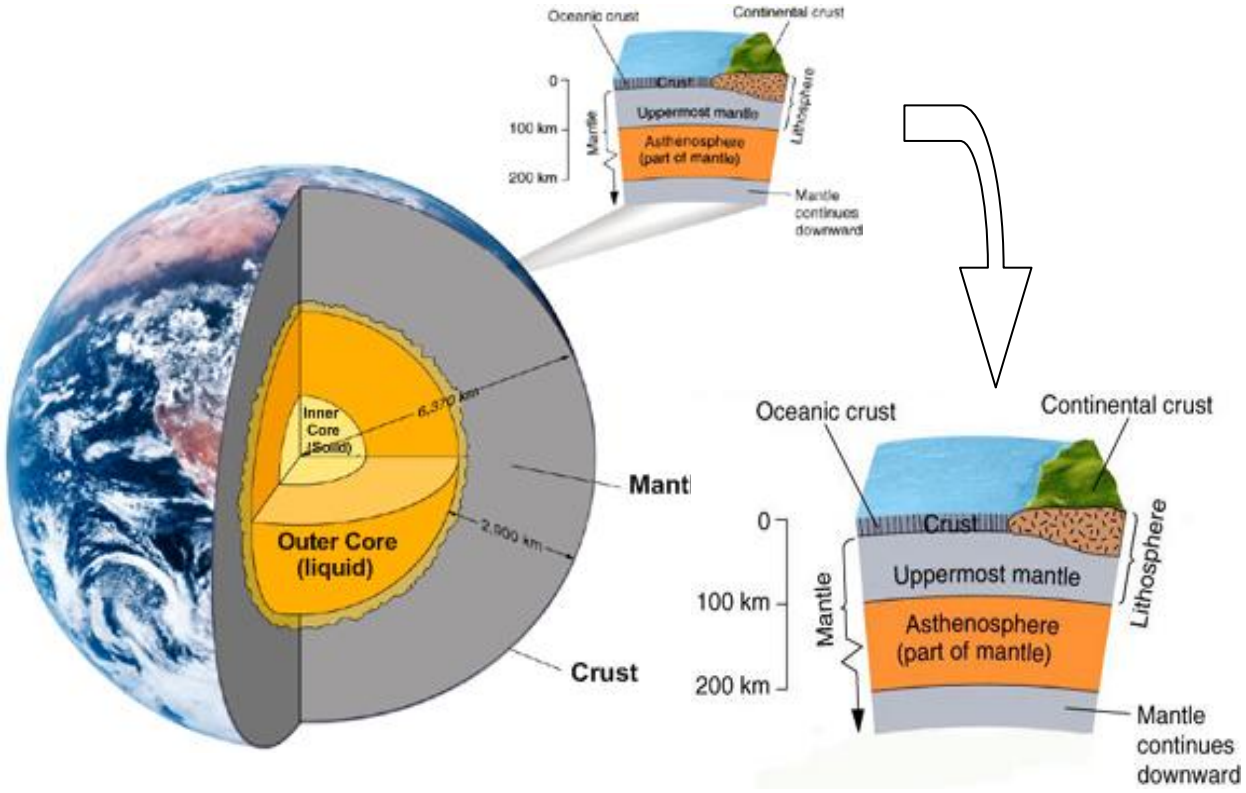
Layers of Earth:

A) Compositional Layers

- ***Crust* (~3-70 km thick):** Very thin outer rocky shell of Earth
  - Continental crust - thicker and less dense
  - Oceanic crust - thinner and more dense
- ***Mantle* (~2900 km thick):** Hot solid that flows slowly over time; Fe-, Mg-, Si-rich minerals
- ***Core* (~3400 km radius)**
  - Outer core - metallic liquid; mostly iron
  - Inner core - metallic solid; mostly iron

B) Mechanical Layers

- ***Lithosphere (~100 km thick)***
  - Rigid/brittle outer shell of Earth
  - Composed of both crust and uppermost mantle
  - Make s up Earth's tectonic "plates"
- ***Asthenosphere***
  - Plastic (capable of flow) zone on which the lithosphere "floats"



Theory of Plate Tectonics

Plate Tectonics is a theory developed in the late 1960s, to explain how the outer layers of the Earth move and deform.

By combining the *sea floor spreading theory* with *continental drift* and information on *global seismicity*, the new theory of Plate Tectonics became a coherent theory to explain crustal movement.

Properties of Plate Tectonics Theory

1. Originally proposed in the late 1960s.
2. Included new understanding of the seafloor and explanation of driving force.
3. Describes lithosphere as being broken into plates that are in motion.
4. Explains origin and locations of such things as volcanoes, fault zones and Mountain belts.

Plates of the earth which are build the Plate Tectonic theory composed of lithosphere, about 100 km thick, that "float" on the ductile asthenosphere. The plate boundaries can be identified because they are zones along which earthquakes occur. Plate interiors have much fewer earthquakes.

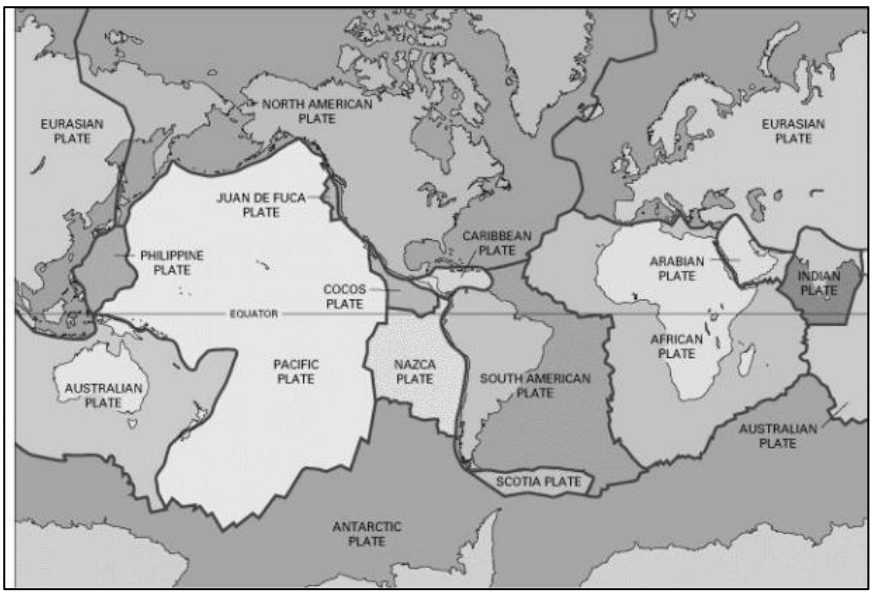
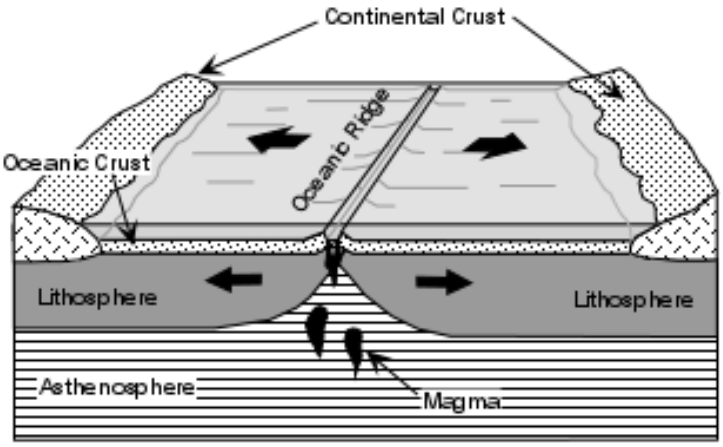


Plate Boundaries:

There are three types of plate boundaries:

1. **Divergent Plate boundaries**

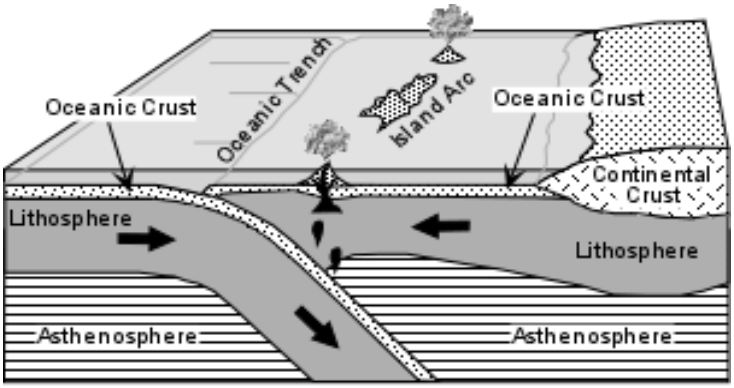
- Plates move away from each other.
- Magma rises, cools and forms new lithosphere
- Typically expressed as *mid-oceanic ridges*



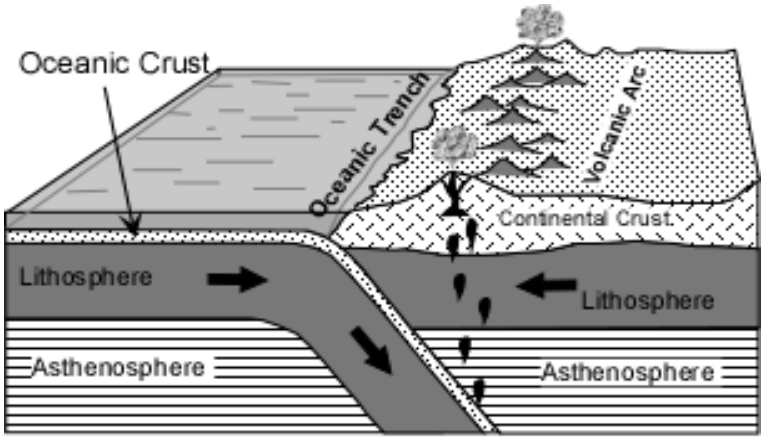
Diverging Plate Boundary
Oceanic Ridge - Spreading Center

2. Convergent Plate boundaries

- Plates move toward each other.
- Mountain belts and volcanoes common
- Oceanic plates may sink into mantle along a *subduction zone*, typically marked by a deep ocean trench



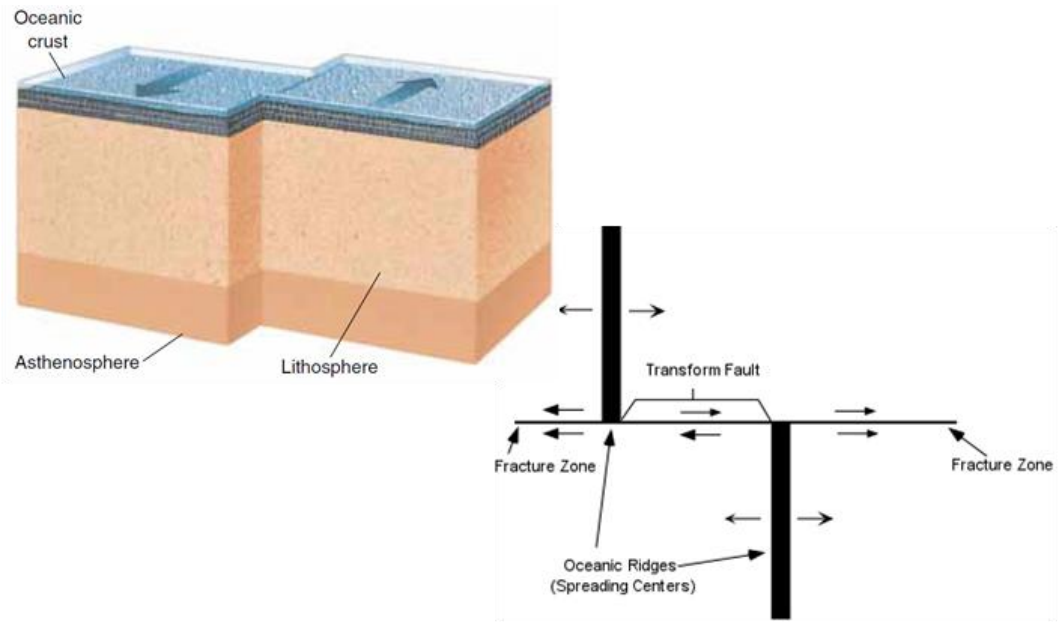
Ocean - Ocean Convergence



Ocean - Continent Convergence

3. Transform Plate Boundaries

- Plates slide past one another.
- Fault zones and earthquakes mark boundary



CHARACTERISTICS AND EXAMPLES OF PLATE BOUNDARIES

TYPE OF BOUNDARY	TYPES OF PLATES INVOLVED	TOPOGRAPHY	GEOLOGIC EVENTS	MODERN EXAMPLES
Divergent	Ocean-ocean	Mid-oceanic ridge	Sea-floor spreading, shallow earthquakes, rising magma, volcanoes	Mid-Atlantic ridge
	Continent-continent	Rift valley	Continents torn apart, earthquakes, rising magma, volcanoes	East African rift
Convergent	Ocean-ocean	Island arcs and ocean trenches	Subduction, deep earthquakes, rising magma, volcanoes, deformation of rocks	Western Aleutians
	Ocean-continent	Mountains and ocean trenches	Subduction, deep earthquakes, rising magma, volcanoes, deformation of rocks	Andes
	Continent-continent	Mountains	Deep earthquakes, deformation of rocks	Himalayas
Transform	Ocean-ocean	Major offset of mid-oceanic ridge axis	Earthquakes	Offset of East Pacific rise in South Pacific
	Continent-continent	Small deformed mountain ranges, deformations along fault	Earthquakes, deformation of rocks	San Andreas fault