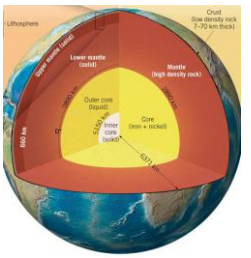
Physical Geology Introduction (Part 2)

- Our Solar System
- Terrestrial Planets
- Jovian Planets
- Nebular Hypothesis
- Formation of the Moon
- Lithospheric Plates
- Earth's Internal Layers
- Geologic Time



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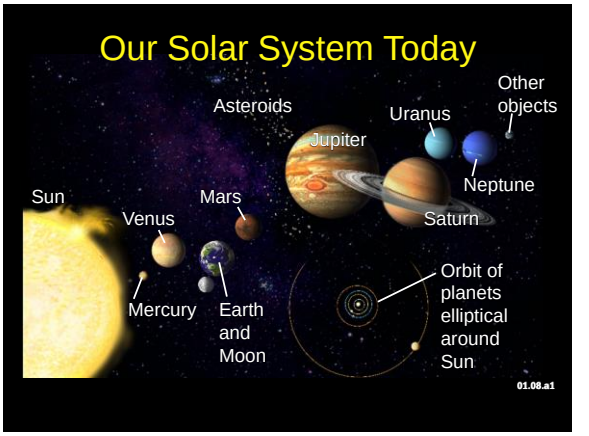

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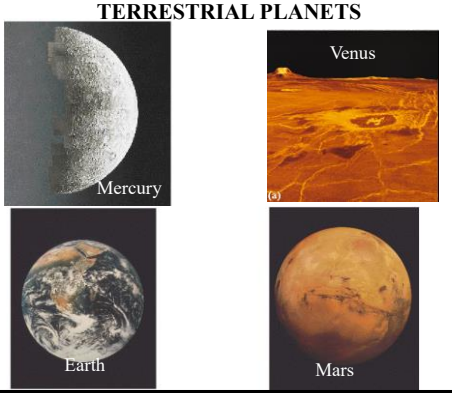
TERRESTRIAL PLANETS



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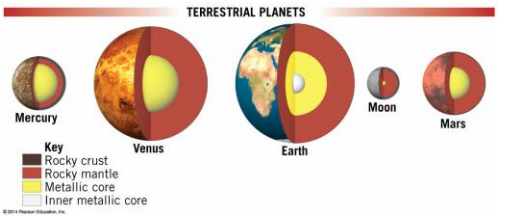

- Closest to the Sun
- Generally small, rocky bodies with densities greater than 3gm/cm^3
- Composed mainly of, Fe, Ni, and silicate minerals
- Volcanism mostly basaltic

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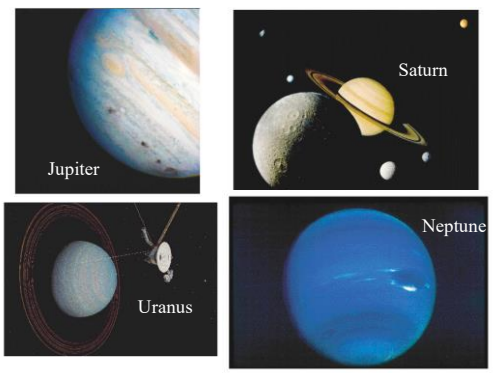
JOVIAN (GIANT) PLANETS



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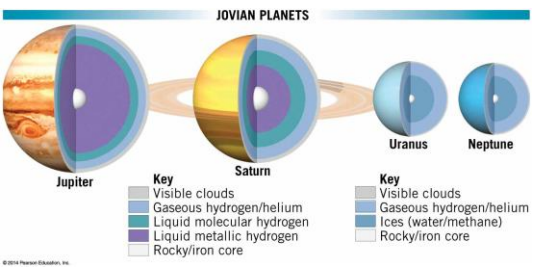

- Each has solid rocky core surrounded by layers of frozen or liquid hydrogen, helium, water, and/or methane
- Multiple moons
- Impressive ring systems composed of dust- to boulder-sized particles of mostly ice

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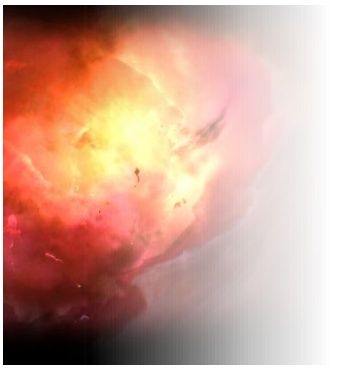

Nebular Hypothesis

The Sun, planets, and other objects in our solar system formed from a giant cloud of gas and dust called the **solar nebula** beginning ~4.6 billion years ago

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Composition of the Solar Nebula

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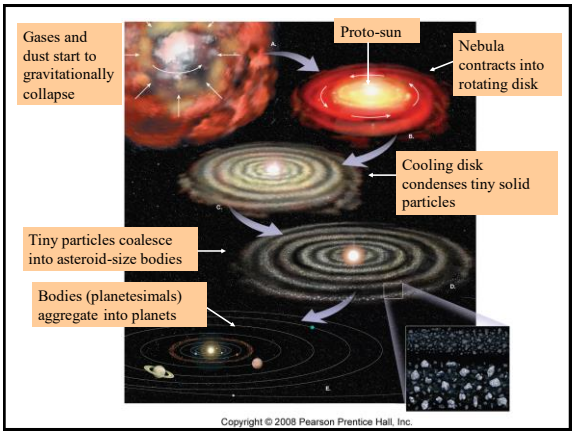

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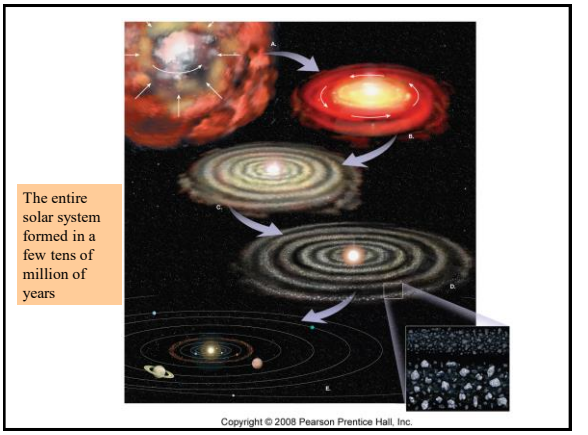

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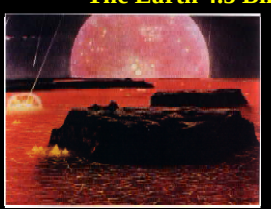
The Earth 4.5 Billion Years Ago



Early Earth was extremely hot and covered by a magma ocean hundreds of km deep

Magma ocean cooled and crystallized from the bottom-up over millions of years to form Earth's internal, layered structure

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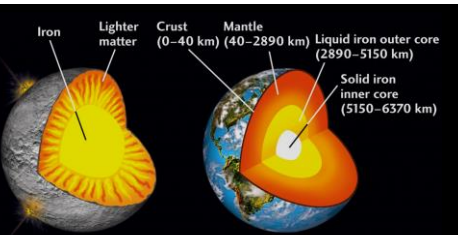

- Hot, softened inner (terrestrial) planets separated into layers based on densities of different materials
- Heavy metals (mostly iron) sank to the center
- Lighter, molten material migrated towards the surface to produce a primitive crust
- This chemical separation that established the basic divisions of Earth's interior and surface is known as planetary differentiation

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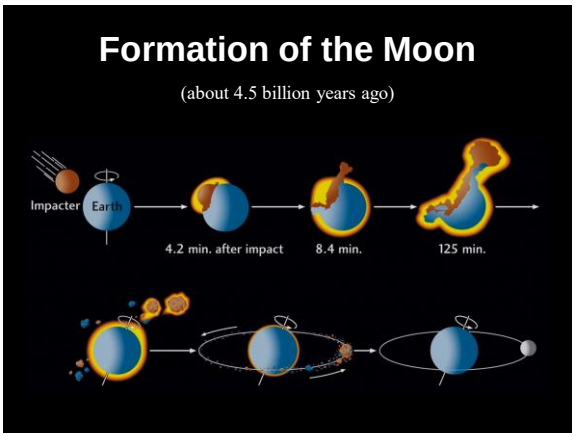

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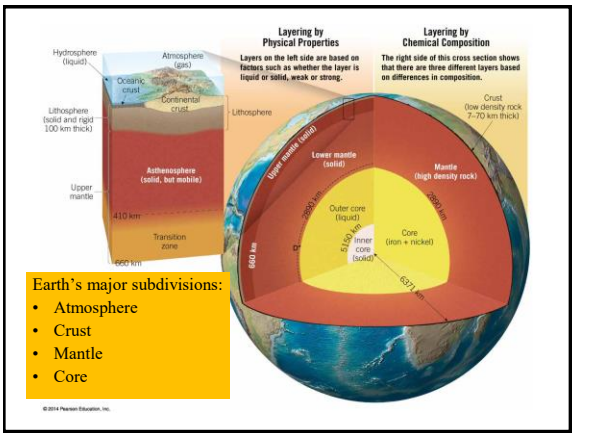

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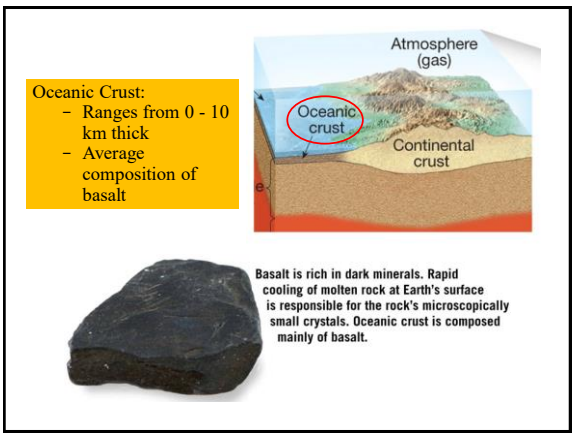

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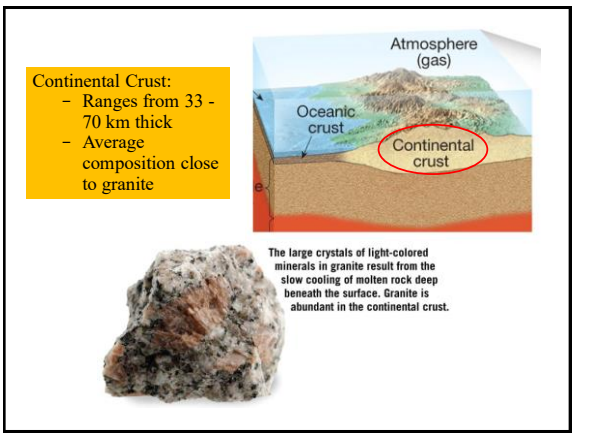

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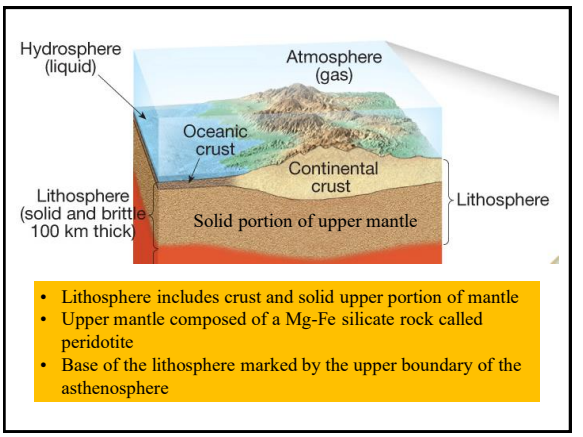

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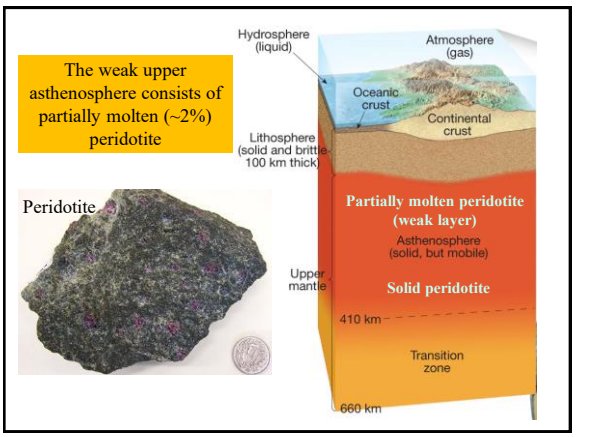

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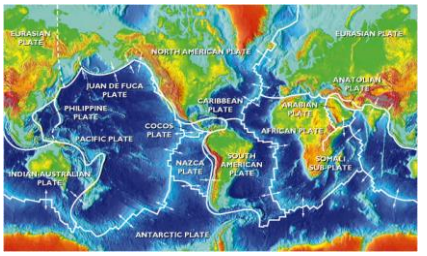
Lithospheric Plates



- Rigid lithosphere glides over weak asthenosphere:
  - Lithosphere broken into a series of plates
- Surface of the earth envisioned as a mosaic of lithospheric plates

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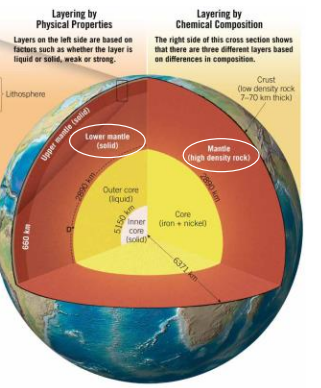
- Below the asthenosphere, the mantle is solid down to a depth of ~2,900 km where it meets the outer core
- Lower mantle composed of a high-density, Mg-silicate rock called perovskite (bridgmanite)



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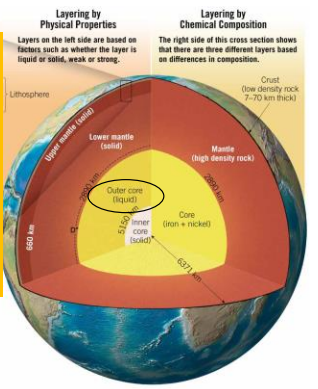
Outer Core:
- Extends from 2,900 km to 5,100 km depth
- Consists mainly of molten (liquid) iron
- Source of Earth's magnetic field



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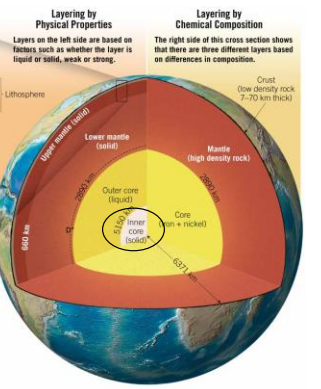
Outer Core:
- Extends from 2,900 km to 5,100 km depth
- Consists mainly of molten (liquid) iron
- Source of Earth's magnetic field

Inner Core:
- Extends from 5,100 km depth to the center of the Earth
- Composed mostly of solid iron and nickel



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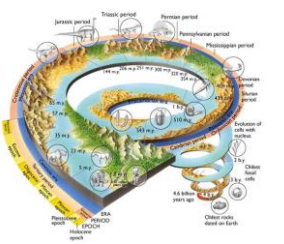
Geologic Time

- Earth is 4.57 billion years old
- Little is known about the first ~4.0 billion years of Earth history (Precambrian Eon) because older rocks have been remelted and deformed numerous times (difficult to interpret)
- We know more about the last 542 million years (Phanerozoic Eon) since younger rocks are more accessible and less altered (many in their original state)



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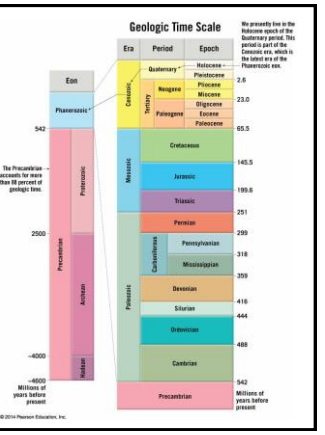
Geologic Time

Geologic time is represented by the Geologic Time Scale:
- Involves vast times – millions to billions of years
- Many geological processes are very gradual and only noticeable over time scales of thousands to millions of years



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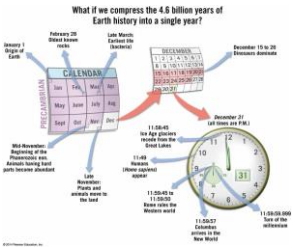
Geologic Time Compressed Into A Single Year

- Jan. 1: Origin of Earth
- Feb. 20: Oldest known rocks
- Late March: Earliest life (bacteria) appear
- Mid-November: Shelly marine organisms become abundant in the fossil record
- Late November: Plants and animals move onto land



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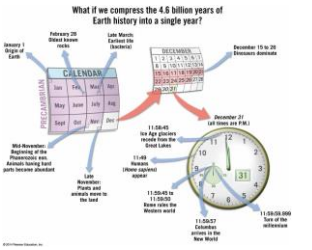
Geologic Time Compressed Into A Single Year

- December 15-26: Age of dinosaurs
- December 31:
  - 11:49 PM: Humans (Homo sapiens) appear 11 minutes before end of Earth Year
  - 11:58:45: Most recent glacial advance
  - 11:59 PM: All of recorded human history occurs within the last minute of Earth Year



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Match Each Description On The Left With The Appropriate Term On The Right

1. Formation of Earth's internal layering
2. Earth impacted by Mars-sized object
3. Planet with an iron core
4. Saturn
5. Venus
6. Rocky core surrounded by layers of gaseous/liquid hydrogen and helium
7. Planetesimals
8. Internal materials separate based on densities
9. Rotating disk of gas and dust
10. Planet with rocky mantle and crust
11. Planet with multiple Moons

A. Giant (Jovian) Planet
B. Terrestrial Planet
C. Planetary differentiation
D. Solar nebula theory
E. Formation of Moon

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