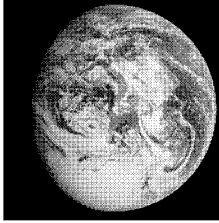


Monday, October 4  
The Earth We Stand On



"We are acquainted with a mere pellicle of the globe on which we live. Most have not delved six feet beneath the surface" - Henry Thoreau

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The Earth We Stand On  
Key Concepts

- 1) The Earth is differentiated into crust, mantle, outer core, and inner core.
- 2) The surface of the Earth is fractured into **plates** that move relative to each other.
- 3) The motion of liquid metal in the outer core produces the Earth's **magnetic field**.

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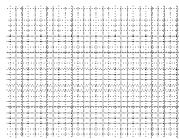
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The Earth's interior is studied using two types of **seismic waves** produced in earthquakes.



**P waves (Primary, Pressure):**  
Sound waves that travel through both liquids and solids.

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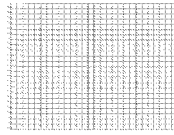
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**S waves (Secondary, Shear):**  
 Transverse (side-to-side) waves that do **not** travel through liquids.



Seismic waves give us a "sonogram" of Earth's interior.

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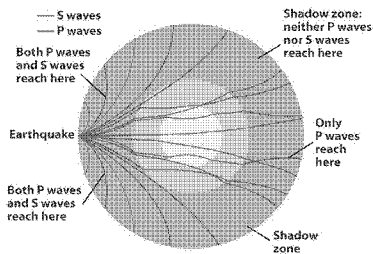
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Seismic waves radiating through the Earth after an earthquake:



S waves don't travel through the outer core!

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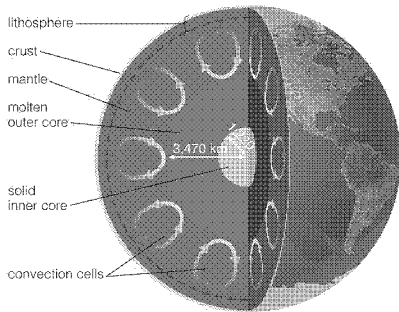
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The Earth is layered into crust, mantle, inner core, and outer core.



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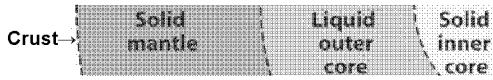
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Outer layers are **rocky**:

- 1) Crust: solid rock
- 2) Mantle: solid & semisolid (plastic) rock

Inner layers are **metallic**:

- 3) Outer core: molten iron & nickel
- 4) Inner core: solid iron & nickel

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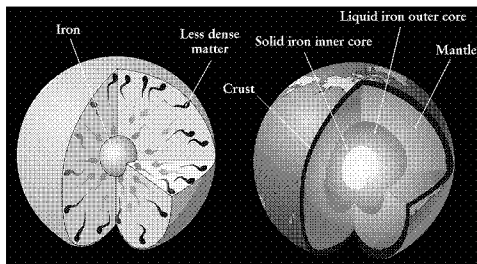
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**Differentiation:** When the early Earth was molten, high-density metal sank to the core; low-density rock rose to the crust.




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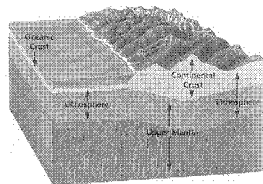
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The crust + top layer of the mantle form the **lithosphere** (solid but brittle).  
Beneath the lithosphere is the **asthenosphere** (plastic).

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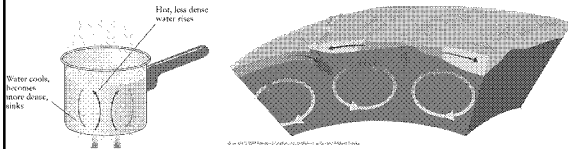
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The asthenosphere, heated from below, undergoes **convection**.



Convection in a pot.

Convection in the asthenosphere.

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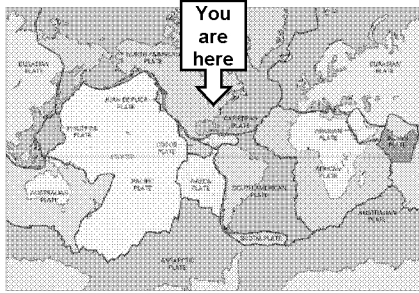
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Convection currents in the asthenosphere have broken the brittle lithosphere into **plates**.



About a dozen large plates.

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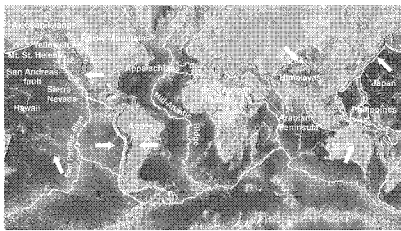
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Continuing convection means the plates are **moving** relative to each other.



Typical speed is about 3 cm/year (measured with GPS).

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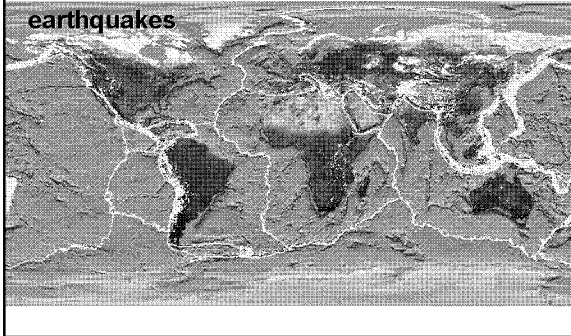
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The boundaries between plates are geologically active, with many earthquakes & volcanoes.



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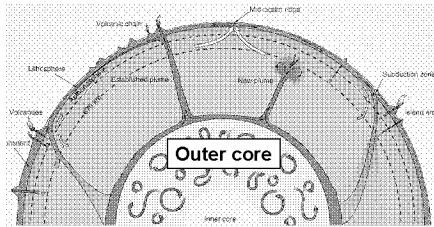
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The Earth is a giant electromagnet.

Inside the Earth, convection currents exist within the liquid outer core.



These currents carry electrons around, creating a magnetic field.

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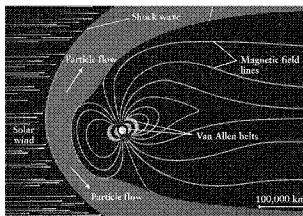
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Earth's magnetic field stretches far beyond Earth's surface.



The magnetic field deflects the **solar wind** (electrons & protons streaming away from the Sun.)

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Tomorrow's Lecture:  
The Air We Breathe



This week's reading:

Chapter 4

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