

Convection and the Mantle

I. Types of Heat Transfer: Heat always moves from a warmer substance to a cooler substance.

To understand how heat moves from Earth's core through the mantle, you need to know how heat is transferred.

A. **Radiation:** the direct transfer of energy through space by electromagnetic waves.

EX: The heat you feel from a fireplace; Sunlight is radiation that warms Earth.

B. **Conduction:** the direct transfer of thermal energy from one substance to another substance that it is touching.

EX: A spoon in a pot of soup on the stove heats up by conduction; Conduction is responsible for some of the heat transfer inside Earth.

C. **Convection:** the transfer of thermal energy by the movement of a fluid.

Heat transfer by convection is caused by differences of temperature and density within a fluid.

Density is a measure of how much mass there is in a volume of a substance.

II. Convection Currents: the movement of a fluid, caused by differences in temperature that transfers heat from one part of a fluid to another.

A. Heating and cooling of a fluid, changes in the fluid's density, and the force of gravity combine to set convection currents in motion.

B. Convection currents continue as long as heat is added; without heat convection currents eventually stop.

III. Convection Currents in Earth

A. Heat from the core and the mantle itself causes convection currents in the mantle.

B. Over millions of years, great heat & pressure in the mantle cause solid mantle rock to flow very slowly.

C. The hot rock eventually cools and sinks back through the mantle.

D. Over and over, the cycle of rising and sinking takes place.

E. There are also convection currents in the outer core that cause Earth's magnetic field.