

Structure of Earth

Density
Layering in Earth
Mountains have roots
Isostasy

Density

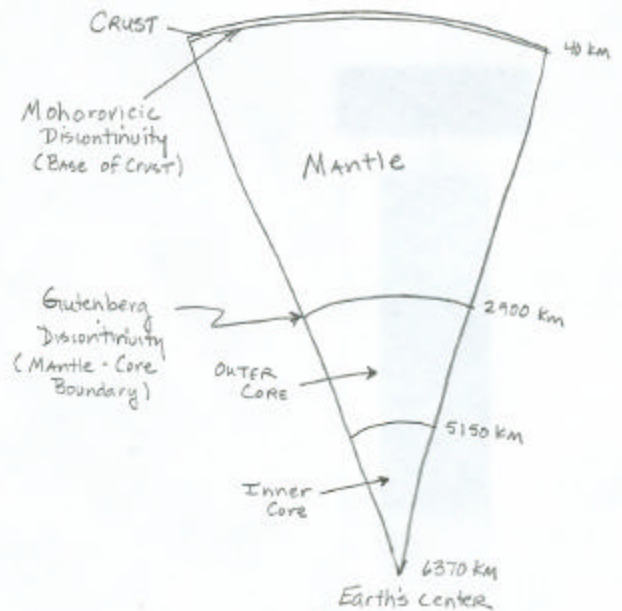
- Density = Mass/Volume
- Change density by changing volume
 - Methods of keeping object same material but changing its volume are heat, pressure
- Change density by changing the chemical makeup of the object. Changing what elements are in an object changes its mass.

Relationship between density and depth in Earth

Density has pattern in that it increases with distance from Earth's surface ([see homework](#)). This pattern is explained as result of

- Gravity has pulled densest materials closest to point of highest gravity, Earth's center
- pressure increases and volume generally decreases

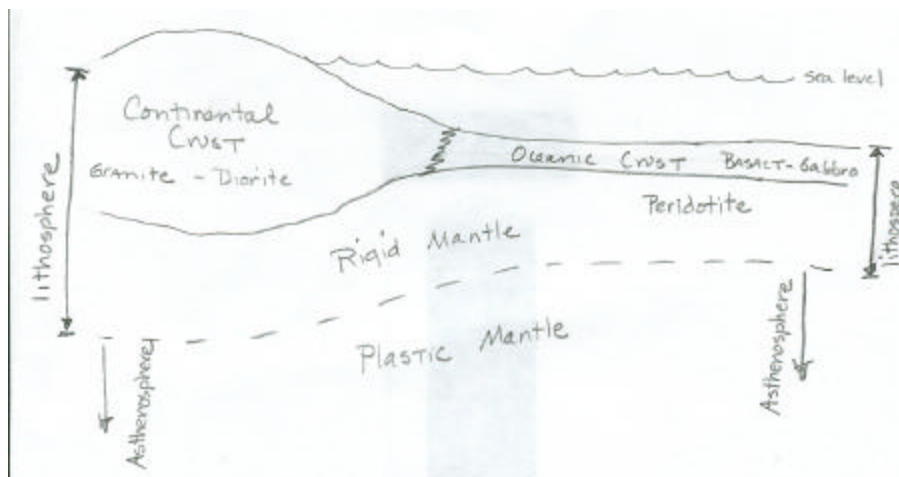
Structure of the Earth



Chemical Composition of Some of Earth's Layers

- Crust- Rich in silicon, oxygen, aluminum (plus sodium, potassium). These are all low mass (weight) elements.
- Mantle- Rich in iron, magnesium, calcium, with some silicon and oxygen. Significant increase in the mass of the elements.
- Core- Mostly iron with some nickel. Very high mass elements. Outer core is liquid, inner core is solid

Structure of Earth's Outer Layers



In this diagram note there are two types of crust, note the igneous rocks that each type is made of, and note the mantle is divided up into two sections (the upper part goes into a layer called lithosphere, the lower part is a layer called asthenosphere).

- There are two types of crust- (see previous diagram or next one)
 - Continental, which is lower density, very high in silicon and oxygen and whose average composition is between a granite and a diorite. This type of crust is relatively thick (averages 40 km)
 - Oceanic, which is higher in density. It is richer in iron and magnesium than continental crust and has composition of basalt (or equivalent gabbro). This type of crust is relatively thin, about 7 km

Other layers of the Earth: Lithosphere and Asthenosphere

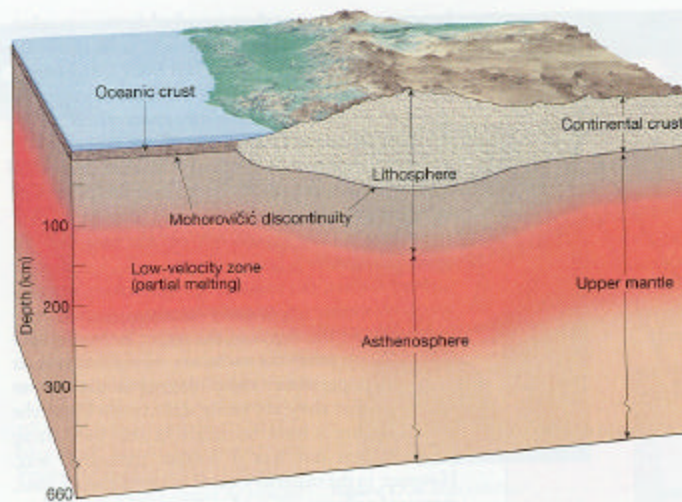
- Lithosphere- The outermost layer of Earth based on physical properties. **INCLUDES both types of crust and the rigid part of upper mantle.** This layer is totally solid and rigid (see previous and next diagrams)
- Asthenosphere- The layer directly under lithosphere. It is partially melted, plastic, and can flow. This layer lies entirely within the mantle.
- Below the asthenosphere is the lower mantle.

Upper Layers of Earth

*Crust (both types) and upper mantle combine into lithosphere layer that is rigid and brittle.

*Plastic layer below lithosphere is asthenosphere. This layer is partially melted and can flow.

Below asthenosphere is solid mantle again. Also see fig 1.6 pg 15 in your book



Two different Ways of Thinking about Earth's layers

1. Some layers of Earth are defined by chemical changes with depth: **crust, mantle, core**. Chemical discontinuities mark the boundaries between those types of layers- Mohorovicic, and Gutenberg
2. Other layers of Earth are defined by physical changes (going from solid to liquid or vice versa): **lithosphere, asthenosphere, lower mantle, outer core, inner core**. There are no chemical discontinuities that mark these layer boundaries. So in the case of the outer core and inner core, both are made of iron. The boundary is a physical transition from liquid to solid. In the case of the lithosphere to asthenosphere, both layers involve the mantle and rock that is peridotite. Here the transition is within the mantle layer and the boundary is between a solid zone and a partially melted (plastic) zone.

Physical layers, especially the lithosphere, are important in understanding plate tectonics.

Chemical Layers versus Physical Layers

Figure from your book pg. 14

