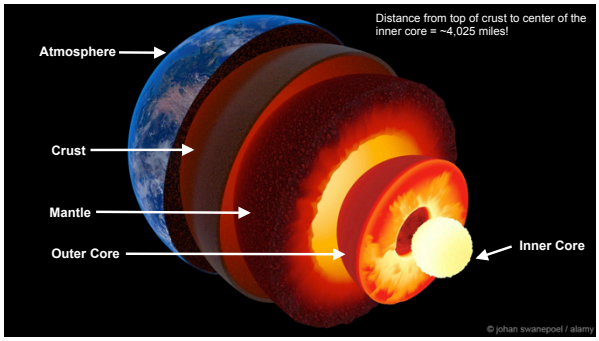
3.2 Plate Boundaries

Main Idea: The Earth moves in different ways, with each movement having its own impact to the Earth's surface.

Borrero, F et al. *Earth Science: Geology, the Environment, and the Universe.* McGraw-Hill: Ohio, 2013. 480-485.



Layers of the Earth

The Earth is comprised of multiple layers, each with their own characteristics

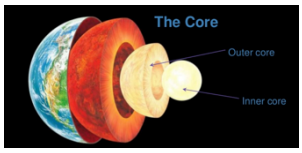
Crust: The layer that we live on. Thinnest of all the layers: 3-5 miles thick under the oceans and about 25 miles thick under the continents. Broken into small pieces called "plates". Crust (+ upper mantle) is called the lithosphere.

Mantle: Located directly under the Earth's crust. Thickest layer of the Earth (1800 miles thick). Composed of very hot, dense rock that **flows.** This deeper, moving part of the mantle is called the asthenosphere.

Layers of the Earth

Outer Core: 1400 miles thick. Extremely hot: 4000 to 9000 degrees Fahrenheit. Made of nickel & iron in the liquid state.

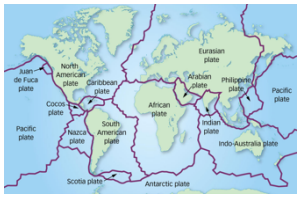
Inner Core: About 800 miles thick. Temperatures reach 9000 degrees Fahrenheit. Made of tightly packed nickel & iron (vibrations).



Layer	Color/Symbols	Information
Inner Core	Red. Tightly packed metals that vibrate.	800 miles thick. This layer is extremely hot, with temperatures reaching 9000 degrees Fahrenheit. Made of tightly packed nickel and iron metals that are forced to vibrate in place as a solid.
Outer Core	Orange. Metals that flow like liquid.	1400 miles thick. This layer is also extremely hot, with temperatures between 4000-9000 degrees Fahrenheit. Consists of the metal nickel and iron (in the liquid state).
Mantle	Yellow. Flowing rock that is very hot.	Located directly under the Earth's crust. Thickest layer of the Earth (1800 miles thick). Temperatures range from 1600-4000 degrees Fahrenheit. Composed of very hot, dense rock that flows. This deeper, moving part of the mantle is called the asthenosphere.
Crust	Blue, green. Ocean and mountains/grass representing oceanic and continental plates.	The crust is the layer that you live on. The crust is only about 3-5 miles thick under the oceans (oceanic crust) and about 25 miles thick under the continents (continental crust). Broken into small pieces called "plates". The crust (along with the uppermost part of the mantle) is called the lithosphere.

Tectonic Plates

- Tectonic plates are huge pieces of crust and rigid upper mantle. Each plate interacts with its neighbor at their edges, called **boundaries**.
- Two types of plates
- Oceanic: made of basalt and are heavy
- Continental: Made of granite and are less dense (lighter)
- 8 major plates on Earth and several small ones



Vocabulary Terminology	Definition
Theory	A well supported, **evidence based explanation** of some aspect of the natural world that is confirmed through repeated observation and experimentation.
Theory of Plate Tectonics	Large pieces of crust and rigid upper mantle fit together to cover the surface of the Earth.

Plate Movements

Tectonic plates move incredibly slow

Only a few centimeters per a year

The speed at which your fingernails grow

Plates move in different directions which can change over time

Because plates are connected by boundaries, when they move they either: move away from each other, press together, or move parallel to each other.

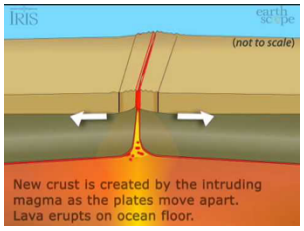
Divergent Boundary

When tectonic plates move apart from each other

- Found on the seafloor in rift valleys

❑ Seafloor Spreading

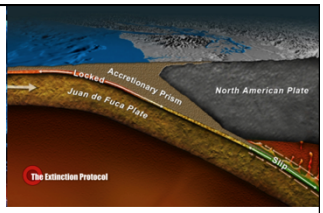
- Continental plates can move apart and create valleys



Convergent Boundary

- When two plates move towards each other. The plates will collide and the denser plate will move below the other plate.
  - This is called **subduction** and where this occurs is called the **subduction zone**

3 types of convergent boundaries



Which type of plate is more dense?

A. Continental plate

B. Oceanic plate

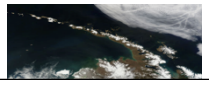
Convergent Boundaries: Oceanic- Oceanic

Subduction zone formed when a denser oceanic plate descends below a less dense oceanic plate

Subducted plate moves into the mantle

Water carried during this process cools the mantle and creates **magma**, which then erupts

This process can create *chain of volcanic islands that run parallel to ocean trenches*



Aleutian Islands, Alaska

Convergent Boundaries: Oceanic- Continental

Subduction zone formed when oceanic plate and continental plates collide

Oceanic plate will subduct because it is denser

Results in *chain of volcanoes along edge of continental plate*

Andes Mountains, Peru-Chile

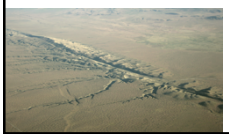
Convergent Boundaries: Continental- Continental

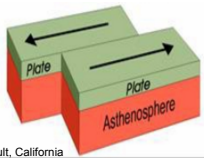
- Occurs when two continental plates collide
- Forms long after ocean and continental plates converge
  1. Oceanic plates drag continental plates towards the subduction zone 2. Oceanic plate will subduct but the attached continental plate cannot because of its similar density 3. Edges of both continental plates collide and become crumpled, folded, and uplifted
- Results in vast mountain ranges

Cascade Mountain Range, Oregon

Transform Boundaries

- When two plates slide horizontally past each other
- Characterized by long faults and shallow earthquakes
- Crust is only slightly deformed or broken here, not destroyed like in other boundary types





San Andreas Fault, California

Vocabulary Terminology	Definition
Divergent Boundary	When tectonic plates move apart from each other.
Convergent Boundary	When plates move towards each other.
Transform Boundary	When two plates slide horizontally past each other.
Subduction Zone	Where two plates come together, resulting in one plate moving beneath the other