

"OK, so what's the speed of dark?"

"When everything is coming your way, you're obviously in the wrong lane."

"Who laughs last, thinks slowest"

JACK

OCNG 251: Oceanography Tuesday, Nov. 11th, 2008

Defining Boundaries: 2) Plate Tectonics II

1. Review
2. Plate Tectonics: The dynamic Earth

Defining Boundaries

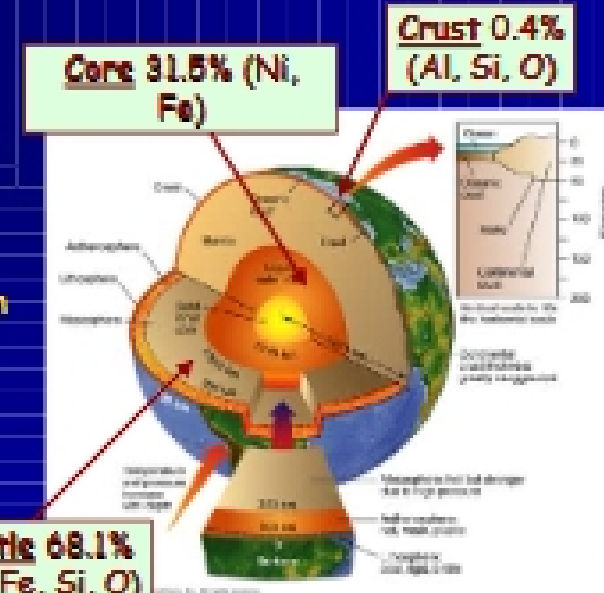
- 1) Marine Provinces
- 2) Intro to Plate Tectonics

1. Marine Provinces
 - Continental Margins (Shelf, Slope, Rise)
 - Deep-Ocean Basins (Abyssal Plains, Abyssal Hills, Seamounts, Trenches)
 - Mid-Oceanic Ridges
2. Intro to Plate Tectonics
 - Differentiation and formation of distinct layers
 - Isostasy (Ocean vs. Continental Crust)
 - Continental Drift and Sea Floor Spreading
 - Evidence...

An Introduction to Plate Tectonics

Originally, the elements segregated during the formation of Earth (density "fractionation")

→ Differentiation and formation of distinct layers seemed to have taken very little time 100My



Core 91.5% (Ni, Fe)

Crust 0.4% (Al, Si, O)

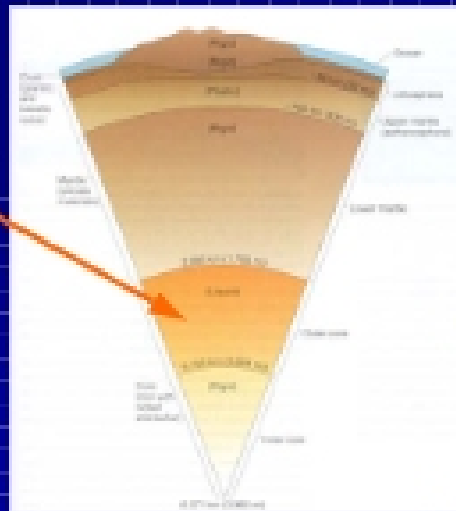
Mantle 68.1% (Mg, Fe, Si, O)

Physical differentiation?

Not all of the core is molten
As Pressure \uparrow , melting point \uparrow
(at higher internal pressures, Fe melts at $>2000^\circ\text{C}$)

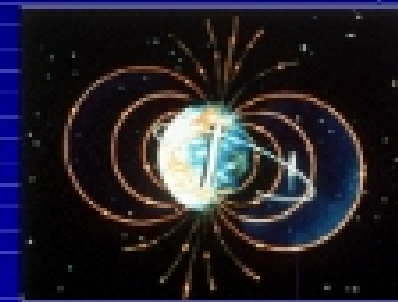
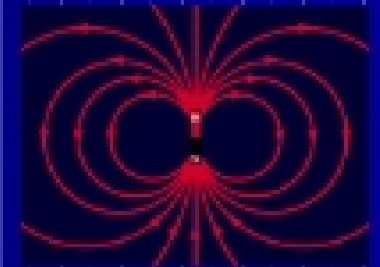
So "liquid" iron only occurs where temperatures are high enough but pressures are low enough

The movements of liquid metal in the outer core (eddies) generate a process akin to a dynamo that generates a magnetic field on Earth (and reversals...)



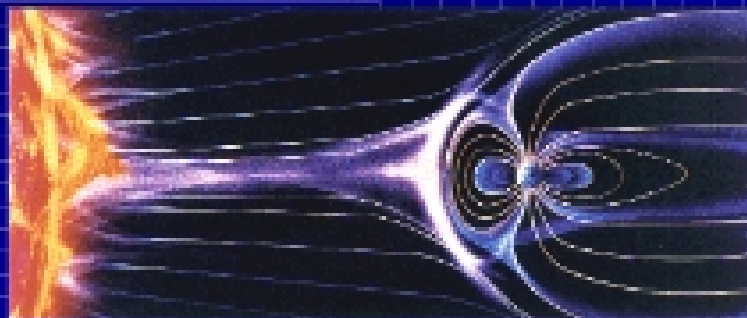
But what does it mean to have a liquid core?

As the result of the Earth's rotation, the molten iron flows continually around the solid inner core \rightarrow forming a magnetic field



And how does that change our lives?

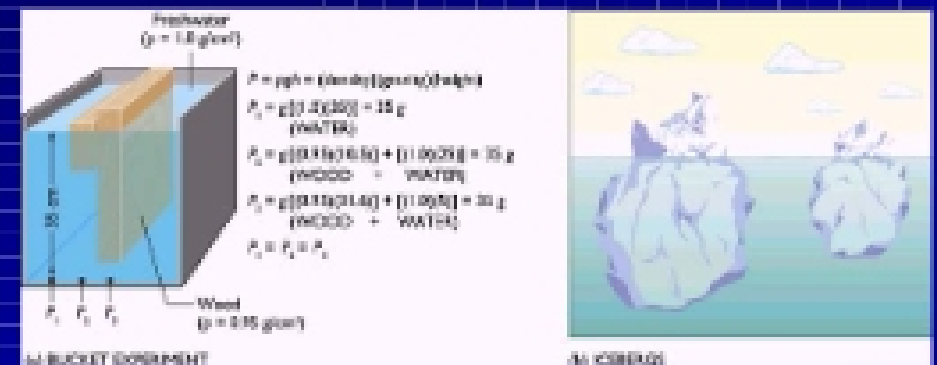
- First of all, it protects us from solar winds...
- But then it provides evidence for differentiation and molten core
- Also provides evidence for Plate Tectonics



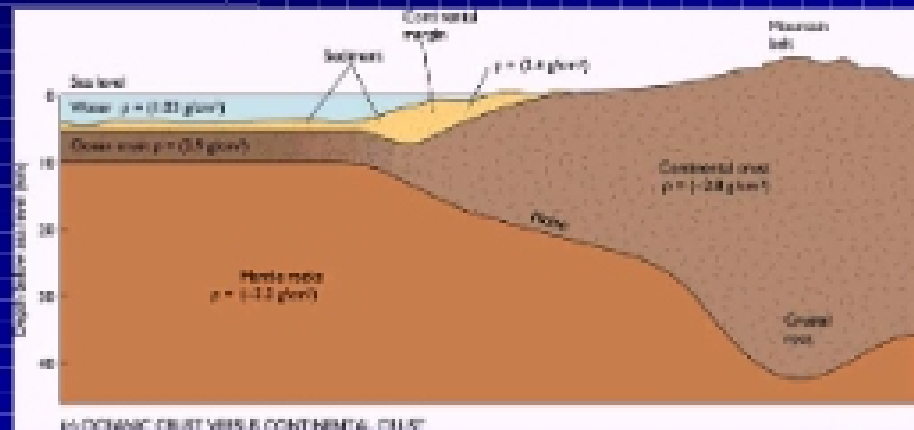
What does it mean to have a plastic Mantle?

Principle of Isostasy

It's a matter of balance



Ocean Crust vs. Continental Crust...



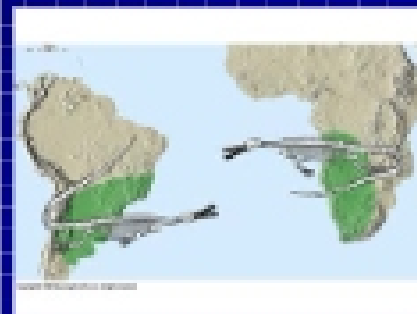
Continental Drift

- Alfred Wegener (1880-1930), German meteorologist, advocated the theory of continental drift in the early XXth Century.
- Drawing on several lines of evidence, he rejuvenated the idea that all the continents were once joined as one landmass, which he named Pangaea.



Continental Drift

- He further proposed that this ancestral supercontinent had begun breaking up approximately 200 million years earlier into a northern portion and a southern portion.
- He noted that land fossils >160 Ma from different continents were similar, whereas fossils <160 Ma were different and had evolved separately.



Continental Drift

- However, the mechanisms he proposed (rotation of the Earth and tidal forces) did not stand the test of science and his "theory" was disregarded!

