Earth Geology

- 11-23-2005

Opening Discussion

- I'd like to start off by thanking everyone who is actually here today.
- I'm not going to go over the minute essays from last time because there are some very significant things to say about them that I want to say when more people are here.

Turning Back to Earth

A big part of the reason we look at the other planets is to help us better understand our own planet and how it works.

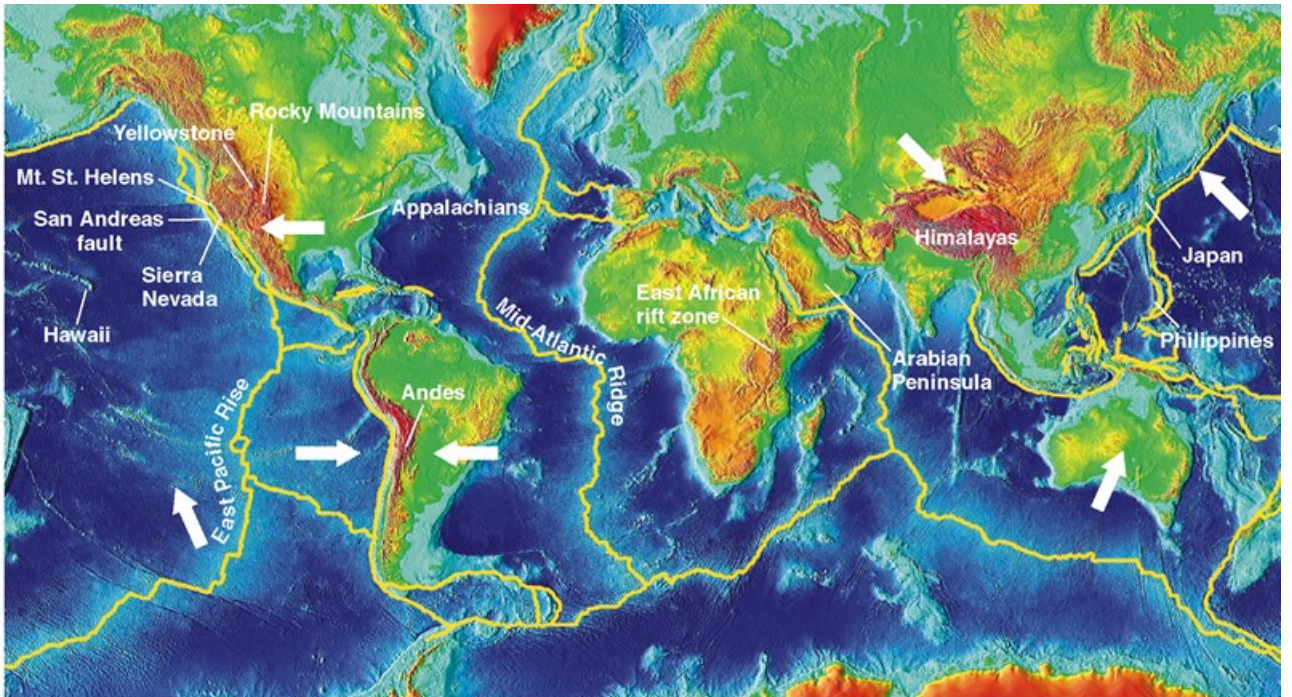
Knowing what we know about other planets can allow us to better understand what effects different changes to our planet will have. It can also enable us to see the significance of processes that might have otherwise seemed mundane.

Uniqueness of Earth

- While the Earth shares many properties with the other planets of our Solar System and it is governed by the same basic principles, the Earth has many features that are unique to it.
  - Just this semester scientists found evidence of plate tectonics on Mars. This isn't fully understood yet and we have a much better picture of how it works on Earth.
  - Our atmosphere is the only one in the Solar System with significant oxygen.
  - Our surface is the only one with large bodies of liquid water.
  - Our climate has been extremely stable.
  - The Earth has abundant life.

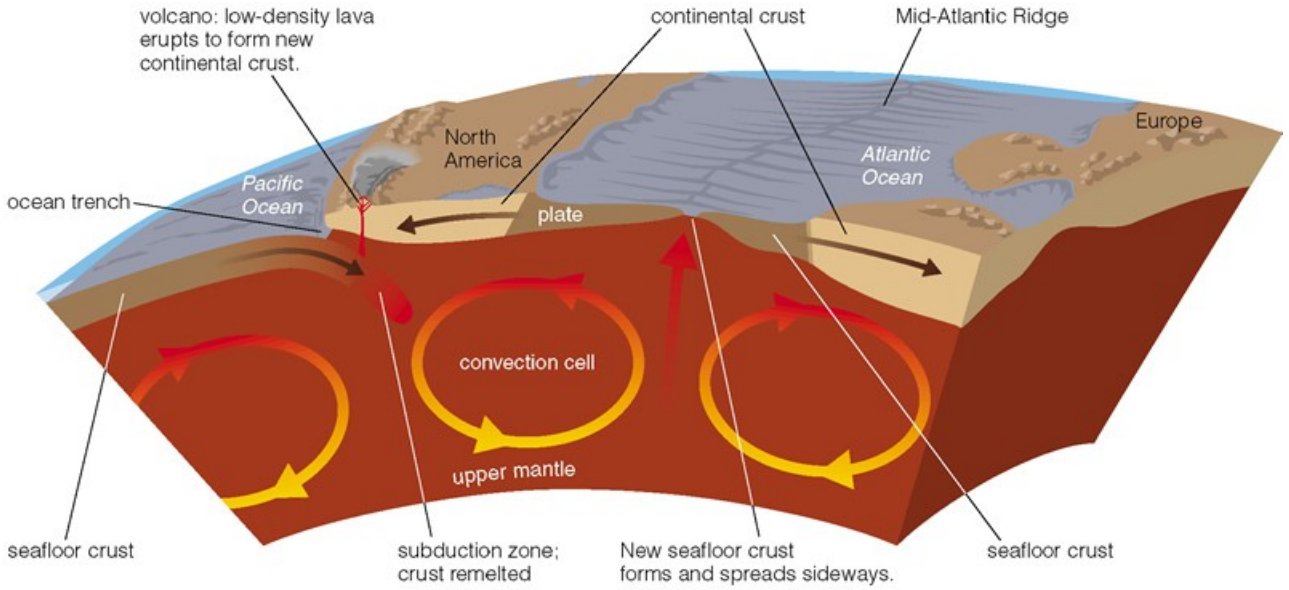
Plate Tectonics

- The most unique feature of the Earth's geology is wide spread, active plate tectonics. The smaller worlds are geologically dead and Venus appears to lack this style of tectonism.
- Our lithosphere is cracked and the plates move about, pushed by convection in the mantle.

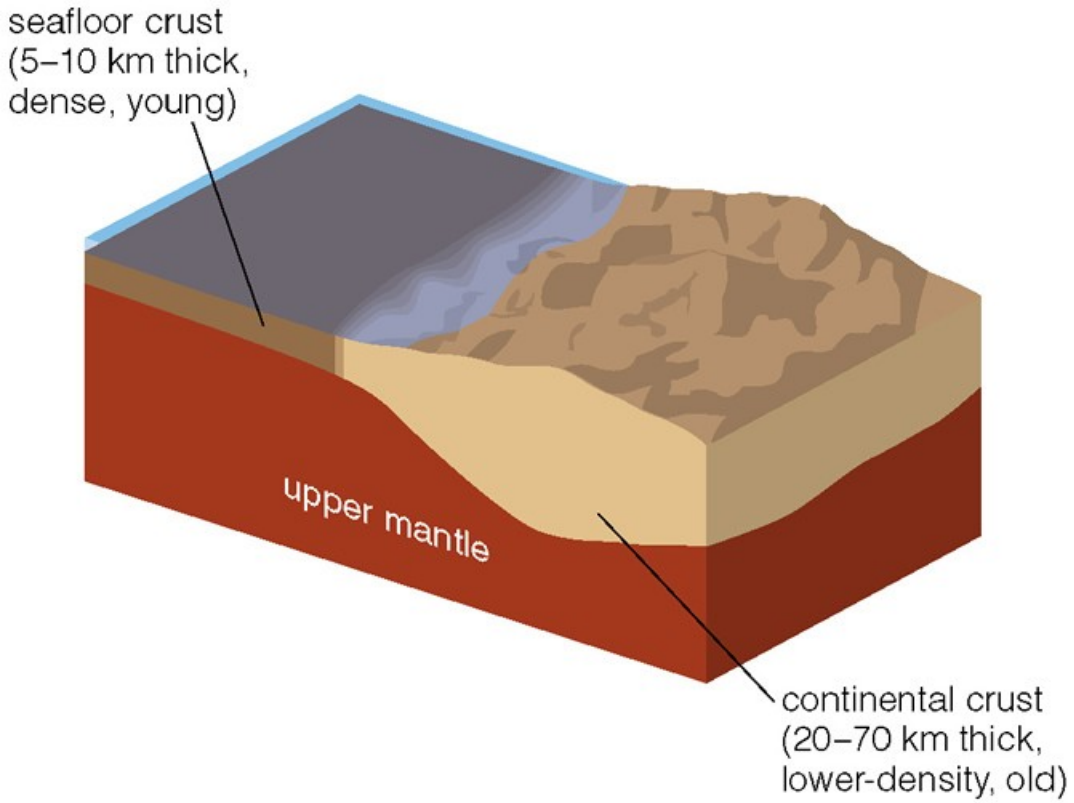


Tectonic Driven Geology

- Because the plates ride on mantle flows, they are pushed apart in some places and squeezed together in others.
- Oceans ridges spread at speeds of several cm/year. In other places plates are pushed down into the mantle at that same speed, but less uniformly.



Different Types of Crust



- The Earth actually has two different types of crust, a thin, dense, young basaltic crust that lies under the oceans and a less dense, thicker crust that makes up the continents.
- Originally there wasn't much of any continental crust. That actually formed over time through reprocessing of crust material.

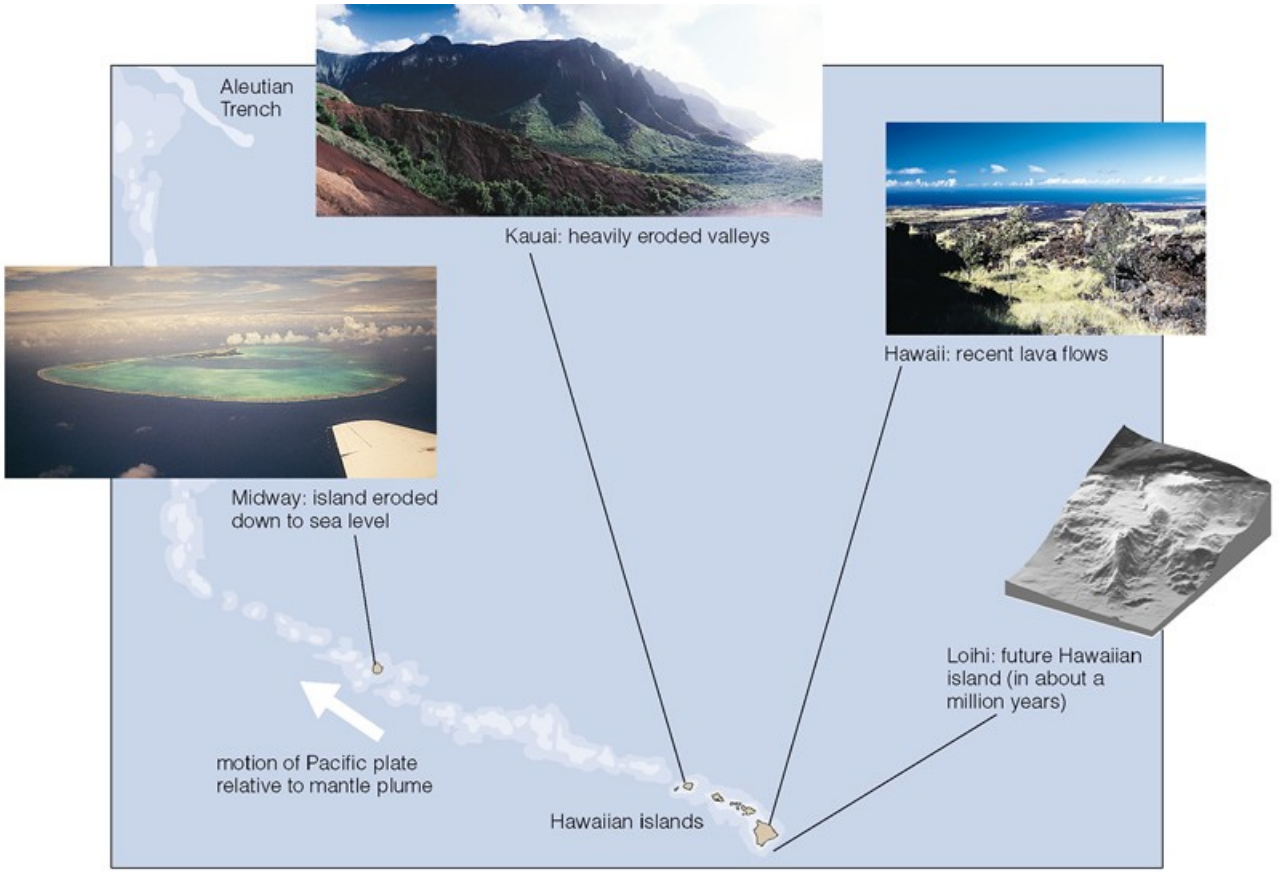
Forming Continents

- The continental crust forms because the lighter elements typically melt faster at subduction and those are what comes up in volcanoes at subduction zones.
- Once it has formed, the low density continental crust doesn't get pushed down so it builds up over time.
- When continental plates run into one another continental crust gets scraped together and the continent grows. This is also the primary process of mountain building on the Earth.

Faults

Hot Spots

- Not all volcanism occurs at plate boundaries. Hot spots in the mantle can produce basaltic flows.



THE MAKING OF TEXAS

Ian W.D. Dalziel and L.M. Gahagan
Institute for Geophysics; The University of Texas at Austin;
4412 Spicewood Springs Road, Bldg. 600; Austin, Texas 78759;
e-mail: ian@utig.ig.utexas.edu

RODINIA SUPERCONTINENT

EARLY NEOPROTEROZOIC, 1000-750 million years

Earliest development of macroscopic life

PANNOTIA SUPERCONTINENT

END PRECAMBRIAN, 545 million years

Cambrian 'explosion' of macroscopic life

ISOLATED AND EQUATORIAL NORTH AMERICA, POLAR GONDWANA

Cambrian, 520 million years

Radiation of invertebrates

ARTEJIA SUPERCONTINENT

Mid-Ordovician, 465 million years

Biologic extinction event

LAURUSSIA SUPERCONTINENT

Silurian-Devonian, 400 million years

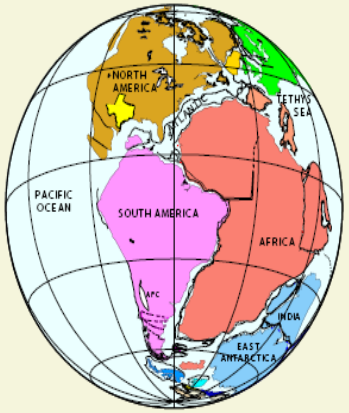
First land animals and flowering plants

PANGEA SUPERCONTINENT

Triassic, 200 million years

Earliest dinosaurs

CENTRAL ATLANTIC OCEAN BASIN AND GULF OF MEXICO OPEN



Mid-Jurassic, 165 million years

'Jurassic Park'

SOUTH ATLANTIC OCEAN OPENS

Mid-Cretaceous, 100 million years

Dinosaur groups isolated

METEOR IMPACT AT CHIXCULUB, YUCATAN

Cretaceous-Tertiary Boundary, 65 million years

Extinction of dinosaurs

UT LONGHORN'S WORLD

Present day

Hominids

We wish to thank BG Technology, Conoco, Elf Exploration Production, Exxon, Norsk Hydro and Statoil for their support of the PLATES Project.

Minute Essay

- Put your name on a piece of paper and have a Happy Thanksgiving.