Plate Tectonics
GEOL 101 Lecture 24

The Grand Tetons, Wyoming
How Are Mountains Built?

Spread Centers Feed Subduction Zones

Missing Mechanisms for Continental Drift:
Sea Floor Spreading & Subduction

Continents are Passive “Boats”
Subduction Zones: Ocean-Ocean Margin

Subduction Zones: Ocean-Continent Margin

Orogeny Associated with Subduction Zone

Single Figure with Some Vertical Exaggeration

Plummer et al. 10th ed, Figure 20.6
How Are Really Big Mountains Built?

Himalayas

Orogeny in the Himalayas
Continental Lithosphere Will NOT Flush Down Subduction Zones

Orogeny Folds Rocks

Review:
New Lithosphere (Crust + Upper Mantle) is Created at Spread Centers, Consumed at Subduction Zones
What About Offsets in Spread Centers?

Transform Faults & Fracture Zones

Transform Faults
San Andreas Fault: Right-Lateral Transform Fault

Left-Lateral Offset!!
Why?: Fault is Produced by Offset, vs. Offset Produced by Fault

Plate Margins:
• Spread Centers (Mid-Ocean Ridges)
• Subduction Zones (Trenches)
• Transform Faults
What **Drives** Plate Tectonics?

1. Convection Cells in Mantle
2. Sinking of Cool, Dense Plates
3. Mantle Plumes - Hot Spots
Convection Cells

Convection Cells in Mantle
• Known “Hot Spots”

Hawaiian Islands

Numbers = Age of Rock in Millions of Years
Volcanoes surrounded by fringing coral reefs.

Atolls: Submerged volcanos support reefs only in warm clear seas. Tuamoto Islands.
Continental Accretion

- The Craton: The Old Core of the Continent
- Mostly Exposed in the Canadian Shield

Plate Tectonic Evolution of Eastern North America

- Suspect Terranes

Accreted or “Suspect” Terranes in Western USA, Canada
History of “Suspect” Terrane Accretion in Western North America

Plate Tectonic Evolution of North America: Accretion of Terranes

A: Cambrian
B: Ordovician-Silurian (Taconic Orogeny)
C: Devonian-Mississippian (Acadian Orogeny)
D: Pennsylvanian-Permian (Alleghanian Orogeny)
F: Triassic
Orogeny: Eastern N. Amer.

“Mirror” Image of West Coast

Taconic Orogeny

Source: http://vishnu.glg.nau.edu/rcb/

Early Silurian 440 Ma

Middle Silurian 430 Ma
Alleghenian Orogeny
Continent-Continent Collision

Late Pennsylvanian 300 Ma

Alleghenian Orogen Folded Appalachian Rocks

“Mirror” Image of West Coast
Pangaea = Gondwanaland + Laurasia

Source: http://vishnu.glg.nau.edu/rcb/Penn.jpg

Alleghenian Orogeny

Source: http://vishnu.glg.nau.edu/rcb/WVU

Pangaea = Gondwanaland + Laurasia

Source: http://vishnu.glg.nau.edu/rcb/Perm.jpg
Erosion and Isostatic Uplift of the Appalachians Since End of Alleghenian Orogeny

Source: http://vishnu.glg.nau.edu/rcb/160_1st.jpg

Source: http://vishnu.glg.nau.edu/rcb/

Source: http://vishnu.glg.nau.edu/rcb/