Chapter 10
Evolution of Continental Crust

Continental Crust Terms

- Orogeny
- Epeirogeny
- Terrane
- Accreted Terrane
- Mantle Plume
- Hot Spot Volcanism
- Wilson Cycle
- Basin
- Dome
- Accretion
- Craton
- Shield

Continental Crust

- It's thick (30-60km),
- It's old (250 - 4000 my),
- It's light ($\rho = 2.75 \text{ g/cm}^3$)
- It's silicic (dioritic to granitic in composition).
- It has a stable interior called the craton.
- It grows at active margins.
- It does not subduct.

Continental Crust

- Because continental crust is thick and old, it has experienced and recorded many orogenic events.
  - It is extremely heterogeneous
  - Oldest continental rocks are about 4 billion years old.
  - The oldest oceanic rocks are only 200 million years old.
Cratons and Shields

- The craton is the stable interior part of the continent.
- The craton may be covered by a thin (<2km) veneer of sedimentary rocks.
- The shield is that portion of the craton that is free of sedimentary cover.
- Shields occur in Canada, Southern Africa, Western Australia, and Scandinavia.

Terranes

- A terrane is a co-genetic block of crust.
- Continents are composed of terranes or blocks of similar age and origin.
- The terrane we are on gives a metamorphic age of 1800 my.
- The CO-WY border is also a terrane boundary.
- The Wyoming terrane is Archean.

Growth of Continents

- Continents grow at active margins.
- They grow by addition of accreted or exotic terranes.
- A exotic terrane (= accreted terrane) is a small block of crust “scraped off” a subducting plate.
- Much of SE Alaska and British Columbia is composed of accreted terranes.
**Mountain Belts**

- An **orogeny** is an episode of mountain building.
- An **orogenic belt** is a co-genetic belt of mountain ranges. (e.g. Alps, Himalayas, Rocky Mountains)
- Mountain belts tend to have thicker sedimentary cover (2-10 km).

**Wilson Cycle**

- The cycle of opening and closing of ocean basins is called the Wilson Cycle.
- Continents can be rifted by the formation of new ocean crust.
- Continents can fuse or collide as in the Alpine-Himalaya orogeny.

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**Plate tectonic movements and ocean basins**

Earth System Figure 10.18 (page 232)
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Rifting splits the continent...
...leading to the creation of new oceanic crust.

Passive margin cooling occurs and sediment accumulates.

Convergence begins: an oceanic plate subducts beneath a continental plate, creating a volcanic chain.

Terrane accretion welds material to the continent.

Orogeny thickens the crust and builds mountains, forming a new supercontinent.

The continent erodes, thinning the crust. Rifting may begin the process again.
**Plumes and Hot Spots**

- A ‘Plume’ is a small convective upwelling from the mantle.
- Plumes may cause ‘hot spot’ volcanism
  - Yellowstone
  - Hawaii

**Plume Hypothesis**

**Orogeny and Epeirogeny**

- **Orogeny** is an episode of mountain building.
  - Himalayas
  - Alps
  - Rocky Mtns
  - Appalachians

- **Epeirogeny** is regional vertical movement of continental crust
  - Glacial rebound in NE US
  - Rocky Mountains ??

**Epeirogeny: example**

**Glacial Rebound**

- Ice load
- Continental crust

**Epeirogeny**

- 1 mm/y = 1000 m/My (!!)
**Continental Crust**

- Western US has several terranes
  - Coast Ranges
  - Cascades - Sierra Nevada
  - Columbia Plateau
  - Snake River (Hot spot track?)
  - Basin and Range
  - Colorado Plateau
  - Rocky Mountains
  - Great Plains

**Continental Crust Terms**

- Orogeny
- Epeirogeny
- Terrane
- Accreted Terrane
- Mantle Plume
- Hot Spot Volcanism
- Hypsographic Curve
- Wilson Cycle
- Basin
- Accretion
- Craton
- Shield

**Clicker Question:**

A small block of crust added on to the active margin of a continent is called a(n)

- A. Accreted Terrane
- B. Shield
- C. Craton
- D. Mantle Plume
- E. Epeirogeny

**The stable interior portion of a continent is the:**

- A. Accreted Terrane
- B. Shield
- C. Craton
- D. Mantle Plume
- E. Epeirogeny
An episode of mountain building is called a(n)

- A. Accreted Terrane
- B. Shield
- C. Craton
- D. Orogeny
- E. Epeirogeny

Upward or downward movement of a region of continental crust is called a(n)

- A. Accreted Terrane
- B. Shield
- C. Craton
- D. Orogeny
- E. Epeirogeny

The stable interior portion of a continent that is not covered by sediments is the:

- A. Accreted Terrane
- B. Shield
- C. Craton
- D. Mantle Plume
- E. Epeirogeny