Today’s outline: *Neogene tectonics*

- Destruction of the Tethyan seaway
- Development of the American west
- Rejuvenation of the Appalachians
Destruction of the Tethyan Seaway

• In Neogene time, Indian Subcontinent and several smaller continental fragments of Gondwanaland collided with Eurasia

• Result was Himalaya Mountains, mountains of the “Near East”, and Alps

• Today, only the Mediterranean Sea, Black Sea, Caspian Sea, and Aral Sea are vestiges of the former Tethyan Seaway
Final drift of Indian Subcontinent
Closure of Tethys Seaway
Modern Geology of the American West

• All **modern physiographic provinces** of the American west were formed during **Neogene time**:
  – Rocky Mountains
  – Colorado Plateau
  – Basin and Range
  – Columbia Plateau/Snake River Plain
  – Cascades
  – Sierra Nevada
  – Coast ranges
Western physiographic provinces
Western physiographic provinces

- **Rocky Mountains** are a very high (~14,000 ft) basement uplift
- **Colorado Plateau** is a high plain (elevation ~5,000 ft) of highly dissected, but nearly flat strata
  - Grand Canyon, Green River Canyon
- **Basin and Range** is an area of semi-parallel mountains and valleys formed by *block faulting*
Green River Canyon
(near Moab, Utah)
Basin and Range

Extensional forces
(stretching)
Western physiographic provinces

- **Columbia Plateau** and **Snake River Plain** is a broad, flat area of extrusive volcanic rocks (basalt flows)
- **Cascades** are volcanic mountains (e.g., Mount St. Helens)
- **Sierra Nevada** is a granitic uplift
- **Coast Ranges** are faulted and folded mountains
Sierra Nevada
Eastern face of Sierra Nevada
Origin of western tectonism

• **Coast Ranges, Cascades, and Columbia River Plateau/Snake River Plain** are directly related to *subduction* along western continental margin.

• Uplift of **Colorado Plateau** and **Rocky Mountains** may be partly isostatic, but mostly related to *swelling within the mantle*.

• **Sierra Nevada** is a basement uplift associated with *plate margin tectonics*.
Origin of western tectonism

- Origin of **Basin and Range** is problematic, but possibly related to western margin tectonics and origin of San Andreas fault
  - Complex interaction where a spreading ridge becomes part of a **subduction zone**
    - *Transform fault* (San Andreas)
    - *Extensional thinning* of the crust (Basin and Range)
San Andreas Fault and crustal thinning (Basin and Range)
Rejuvenation of the Appalachians

• Last episode of deformation in Appalachians was Alleghenian Orogeny
  – Pennsylvanian time
• Appalachians were completely leveled by erosion during Mesozoic time
• Modern topography developed in response to Neogene isostatic uplift
  – Mild, vertical elevation without deformation
Rejuvenation of the Appalachians

- Cretaceous
- Holocene