Tectonics

A branch of geology that deals with the major structural (or deformational) features of the Earth and their origin, relationships, and history...
Tectonic Structure of Continents

- **Craton** or **shield**: Stable part of a continental block that has not experienced deformation for a long time…

- **Mobile Belt**: a compressional mountain belt: long narrow region of crust that has been deformed recently and repeatedly
Shrinking Earth Theory

Prevailing theory in the early 20th century

(This theory was wrong and is a good example of how ideas in science can and do change…)

1) Earth was formed in a molten state. It is still solidifying and shrinking as it cools.

2) Shrinkage causes the previously cooled crust to wrinkle:
   Large wrinkles = continents and ocean basins
   Small wrinkles = mountain belts.

Motion is mainly vertical, not horizontal…

3) Continents are drained as ocean basins warp down and flooded as they fill up with sediment.
Theory of Continental Drift
(Alfred Wegener, 1912)

• Continents are moving laterally across the face of the Earth.

• Continents were joined together in the distant past as a single supercontinent.

• Supercontinent (Pangaea) was surrounded by a superocean (Panthalassa).

• Supercontinent split apart and its pieces are still moving apart today…

• *Motion is mainly horizontal, not vertical…*
Evidence for Continental Drift: I

• Fit of continents (first map and suggestion by Francis Bacon, 1620!)

• Mobile belts near continental margins, NOT randomly distributed.

• Hypsometry of Earth suggests two types of crust, isostatically supported.

• Earth is *oblate spheroid*:
  (6367 +/- 11 km radius viscous liquid, permits *isostatic compensation*).
Evidence for Continental Drift: II

- Distribution of living organisms
- Distribution of fossil organisms
- Distribution of paleoclimatic indicators in rocks:
  - Glacial tills
  - Desert sands
  - Tropical soils
  - Coal beds
  - Coral reefs
Problems with Continental Drift

• Cause (?): Wegener postulated that earth tides and centrifugal forces or “polflucht” (“flight from the poles”) were the driving forces…

• Ideas were rejected by many geophysicists because:
  – Lack of a suitable mechanism: the forces Wegener suggested were too weak to move continents.
  – How could continents “plow through” the ocean floor?
  – Too unconventional: hard to accept even if it made sense.
  – Wegener was a meteorologist so he was considered an outsider.
  – European and N. American geologists mostly rejected his ideas.
Support for Continental Drift

• South African and Australian geologists, however, tended to accept Wegener’s ideas because the geology of those continents seems rather incomplete:

  Major geologic structures in S. Africa & Australia end abruptly at coastlines and seem cleanly cut apart.

  Missing parts of these geologic structures reappear on another continent across the ocean.

• Paleo-evidence mentioned before…

• *Paleomagnetic evidence uncovered in the 1950’s led to a revival of Wegener’s ideas*…
Earth’s magnetic field is generated by:
A. The Sun
B. The gravitational interaction of Earth, the Sun, and Jupiter.
C. The Geodynamo: convection of molten iron in Earth’s outer core, coupled with Earth’s 24-hour rotation.
D. A giant bar magnet inside the Earth.
And now, on to Seafloor Spreading...