Biological Diversity 2

- Conditions on early Earth made the origin of life possible
- The fossil record chronicles life on Earth
- Colonization of land and biogeography

Chemical Conditions on Early Earth

- Atmosphere on early earth very different from today
- Oxygen scarce, reducing atmosphere with more methane, hydrogen, and ammonia than today
- “Primitive soup” experiment by Miller and Urey (1953)

A Different View of Conditions on Early Earth

- Newer evidence suggests early atmosphere may not have been reducing or oxidizing
  - Primarily oxygen and nitrogen
- Role of submerged volcanoes and vents
  - High in minerals, sulfur, iron
  - Important in ATP production

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The Geologic Record

- Origin of earth about 4.6 billion years ago
- Oldest cells (prokaryotes) about 3.5 billion years ago
- Oldest eukaryotes about 2.2 billion years ago
Permian Mass Extinction

- 250 million years ago
- 95% of marine animal species went extinct
- Probably caused by volcanic activity
  - Increased temperatures worldwide
  - Changes in ocean mixing, decreased oxygen

Cretaceous Mass Extinction

- 65 million years ago
  - 50% of marine species went extinct
  - Many terrestrial plant and animal species went extinct, including the dinosaurs
- Probably caused by asteroid or comet
  - Thin layer of clay enriched in iridium (rare on earth, common in meteorites)
  - Likely impact in Yucatan Peninsula

“Cambrian Explosion”

- Most of the major animal phyla appeared during the first part of the Cambrian period (about 500 million years ago)
- New molecular evidence suggests that many phyla probably originated much earlier, however
- What caused the dramatic increase in diversity?
  - New predator-prey relationships
  - Increase in oxygen supported higher metabolic rates

The Cambrian Radiation of Animals
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Colonization of Land

- Colonization of land was a key event in the history of life
  - Occurred about 500 million years ago
- Associated with adaptations for:
  - Preventing water loss
  - Reproducing on land
- Most successful groups on land include
  - Arthropods, especially insects and spider
  - Vertebrates, especially amphibians, reptiles, birds, mammals

Biogeography

- Major factor that correlates with the distribution of life is continental drift
- Earth’s continents are not fixed
  - Float on hot, underlying mantle
  - N. America and Europe are drifting apart at a rate of 2 cm per year
- Size, shape, and position of continents have changed dramatically over geologic time

Two Important Biogeographical Events

1. "Pangaea" formed about 250 million years ago
   - One large "supercontinent"
   - Oceans became deeper, shallows disappeared
   - Reshaped biological diversity, extinctions and opportunities
2. Continents drifted apart about 180 million years ago
   - Can help to explain some interesting "puzzles"
     - Similar fossil reptiles in West Africa and Brazil
     - Unique marsupial fauna in Australia due to isolation

History of Continental Drift

Fig 26.20