

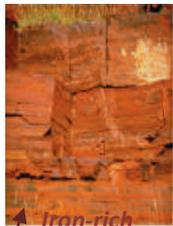
Chapter Outlines

NOTE: This is intended to help students 'organize' their understanding of each topic. It is not a comprehensive study guide for quizzes or midterms, i.e. study your text!

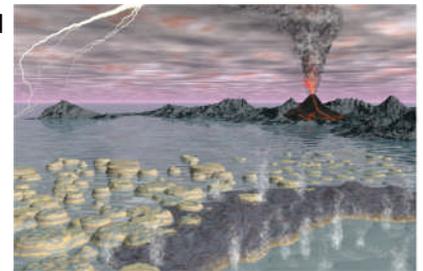
Earth's Evolution through Geologic Time

1) **Precambrian era** - 4.5 billion to 540 million years ago covering 88% of Earth's history

- a) Only sketchy knowledge of this time
- b) Most Precambrian rocks are devoid of fossils, and buried from view
 - i) Each continent has a 'core area' of Precambrian rocks called a **shield**
 - ii) Extensive iron-ore deposits, and absent are fossil fuels
- c) Earth's atmosphere
 - i) Primitive atmosphere formed from volcanic gases in a process called outgassing
 - (1) Water vapor, carbon dioxide, nitrogen, and several trace gases
 - (2) Very little free oxygen
 - ii) Water vapor condensed and formed primitive oceans as Earth cooled
 - iii) Bacteria evolved
 - iv) Plants evolved and photosynthesis produced oxygen, increasing the oxygen content of the atmosphere
 - v) By about **500 mya**, abundant ocean-dwelling organisms that required oxygen existed
- d) Precambrian fossils
 - i) Most common are Stromatolites - material deposited by algae, that were common about 2 billion years ago
 - ii) Microfossils of bacteria and algae have been found in chert - in southern Africa (*3.1 billion years of age*), and Lake Superior area (*1.7 billion years of age*)
- e) Plant fossils (*very primitive*) date from the middle Precambrian
- f) Animal fossils (*very primitive*) date from the late Precambrian
- g) Diverse and multi-celled organisms existed by the close of the Precambrian



Locations of shields/cratons

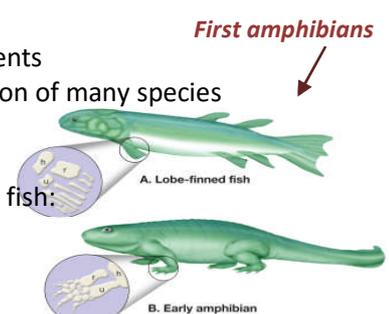
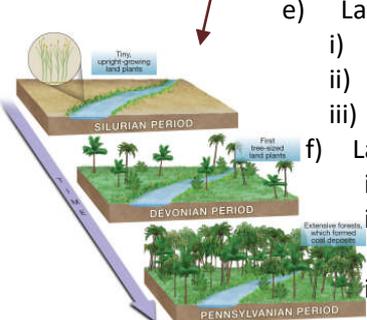


2) **Paleozoic era** - 540 million years ago to about 248 million years ago

- a) First life-forms with hard parts
- b) Abundant Paleozoic fossils
- c) Early Paleozoic history -
 - i) Southern continent of Gondwanaland existed
 - ii) North America
 - (1) A barren lowland where seas moved inland and receded several times, and shallow marine basins evaporated leaving rock salt and gypsum deposits
 - (2) Taconic orogeny, a mountain-building event, affected eastern North America
- d) Early Paleozoic life – was restricted to seas
 - i) Vertebrates had not yet evolved
 - ii) Life consisted of several invertebrate groups: Trilobites, Brachiopods, and Cephalopods
 - iii) First organisms with hard parts, such as shells—perhaps for protection
- e) Late Paleozoic history -
 - i) Supercontinent of Pangaea formed
 - ii) Several mountain belts formed during the movements of the continents
 - iii) World's climate became very seasonal, causing the dramatic extinction of many species
- f) Late Paleozoic life -
 - i) Organisms diversified dramatically
 - ii) Land plants flourished, and fishes evolved into two groups of bony fish: lung fish, and lobe-finned fish that became the amphibians
 - iii) Insects invaded the land



Spread of land plants



- iv) Amphibians diversified rapidly
- v) Extensive coal swamps developed

3) **Mesozoic era** - 248 million years ago to about 65 mya

- a) Often called the '**age of dinosaurs**'
- b) Mesozoic history
 - i) Began with much of the world's land above sea level
 - ii) Seas invaded western North America
 - iii) Breakup of Pangaea began forming the Atlantic Ocean
 - iv) North American plate began to override the Pacific plate
 - v) Mountains of western North America began forming
- c) Mesozoic life (*the survivors of the great Paleozoic extinction*)



Mesozoic forest



Mesozoic 'bird' fossil

- i) Gymnosperms became the dominant trees
- ii) Reptiles (*first true terrestrial animals*) readily adapted to the dry Mesozoic climate
- iii) Reptiles had shell-covered eggs that could be laid on the land
- iv) Dinosaurs dominated
- v) One group of reptiles led to the birds
- vi) Many reptile groups, along with many other groups, became extinct at the close of the Mesozoic



"Rex"

- (1) One hypothesis is that a large asteroid or comet struck Earth
- (2) Another possibility is extensive volcanism

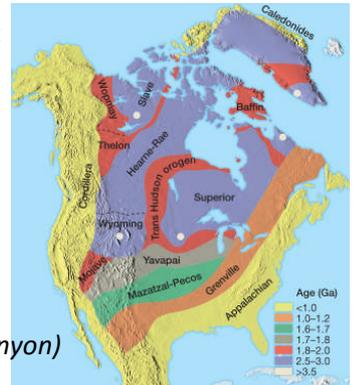
4) **Cenozoic era** - 65 million years ago to the present

- a) Often called the '**age of mammals**'
- b) Smaller fraction of geologic time than either the Paleozoic or the Mesozoic
- c) North America
 - i) Most of the continent was above sea level throughout the Cenozoic era
 - ii) Many events of mountain building, volcanism, and earthquakes in the West
 - iii) Eastern North America



Late-Cretaceous Asteroid impact

- (1) Stable with abundant marine sedimentation
- (2) Eroded Appalachians were raised by isostatic adjustments
- iv) Western North America
 - (1) Building of the Rocky Mountains was coming to an end
 - (2) Large region was uplifted
 - (a) Basin and Range Province formed
 - (b) Re-elevated the Rockies
 - (3) Volcanic activity is common
 - (a) Fissure eruptions formed the Columbia Plateau basalts
 - (b) Volcanoes formed from northern California to the Canadian border
 - (4) California's Coast Ranges formed, and the Sierra Nevada became fault-block mountains



Regional ages

- d) Cenozoic life
 - i) Mammals replaced reptiles as the dominant land animals
 - ii) Angiosperms (*flowering plants with covered seeds*) dominated the plant world
 - 1. Strongly influenced the evolution of both birds and mammals
 - 2. Food source for both birds and mammals
 - iii) Two groups of mammals evolved after the reptilian extinctions at the close of the Mesozoic: the marsupials and the placentals
 - iv) Mammals diversified quite rapidly and some groups became very large
 - (1) Example: hornless rhinoceros, which stood nearly 16 feet high
 - (2) Many large animals became extinct
 - v) Then, as a footnote to all this, humans evolved



marsupial



Our ancestor?