The Story of Geologic Time

Talk With Your Group!

- What do you already know about Geologic time?
  - What do fossils have to do with Geologic time?
  - What about Sedimentary rocks?

  - Be prepared to report out!

What We Know:

What is the Geologic Time Scale?

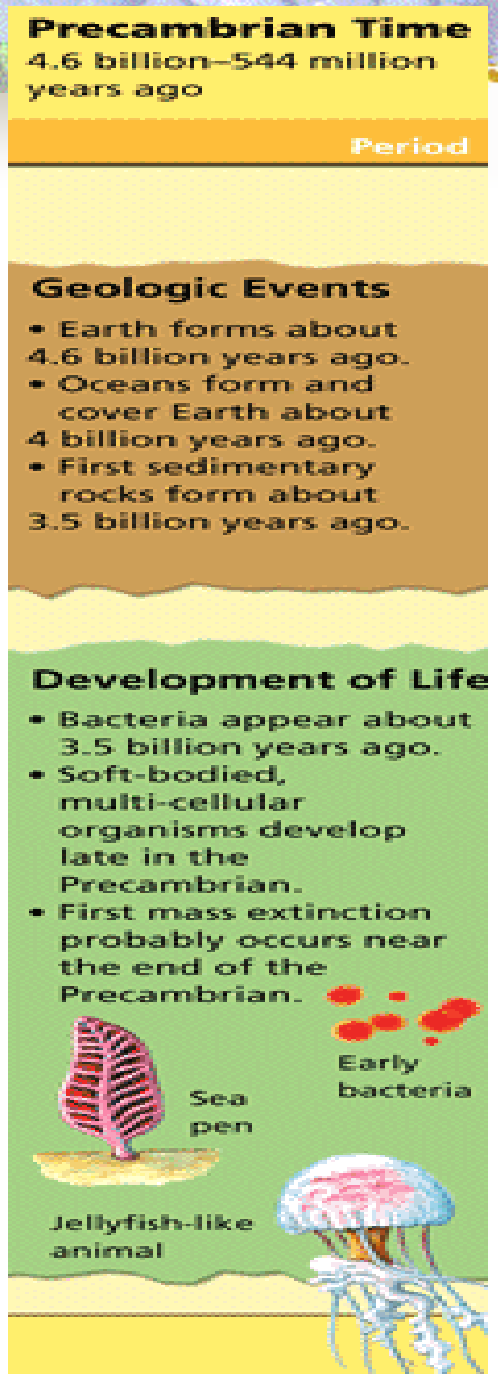
- The division of Earth's history into time periods based on the type of life forms that existed.
- The appearance or disappearance of organisms throughout history marks important events in geologic time.

Think to yourself…

- How is Geologic time different than how we measure time in recent history?

Precambrian Time

- 4.6 billion years ago - 544 million years ago
- What did the Earth look like?
  - Most things lived in the oceans
  - Land covered with volcanoes
- What types of life existed?
  - First Forms of Bacteria
  - Jelly Fish, Worms, and other Soft-bodies animals



Precambrian Fossils

Jelly Fish

Worm-Like Organisms

How did the Pre-Cambrian Era End?

- The appearance of shelled animals marked the beginning of the next era.

The Paleozoic Era

- 544 - 248 million years ago
- What did the Earth Look Like?
  - Warm shallow seas covered much of the Earth
  - Several Mountain ranges began to form as plates collided.
- What types of life existed?
  - Shelled animals especially Trilobites
  - Fish-Like animals without Jaws
  - Toward the end of the era, amphibians and reptiles appeared.
  - Early plants

Paleozoic Era
544–245 million years ago

Cambrian	Ordovician	Silurian
544–505 million years ago	505–438 million years ago	438–408 million years ago
• Shallow seas cover much of the land. • Ancient continents lie near or south of the equator.	• Warm, shallow seas cover much of Earth. • Ice cap covers what is now North Africa.	• Coral reefs develop. • Early continents collide with what is now North America, forming mountains.
		
Clam	Cephalopod	Eurypterid
• Great "explosion" of invertebrate life occurs in seas. • Invertebrates with shells appear, including trilobites and mollusks.	• Invertebrates dominate the oceans. • Early vertebrates—jawless fish—become common.	• Fish with jaws develop. • Land plants appear. • Insects and spiders appear.
Pikaia	Crinoid	Arachnid
Sponges	Jawless fish	Psilophyte
Trilobite	Brachiopod	Jawed fish

Paleozoic Era
544–245 million years ago

Devonian	Carboniferous 360–286 million years ago		Permian
408–360 million years ago	**Mississippian** 360–320 million years ago	**Pennsylvanian** 320–286 million years ago	286–245 million years ago
Geologic Events • Seas rise and fall over what is now North America.	• Appalachian Mountains begin to form. • North America and Northern Europe lie in warm, tropical region.		• Deserts become larger in tropical regions. • The supercontinent Pangaea forms as all continents join together.
			
Development of Life • Age of Fishes begins as sharks and fish with scales and bony skeletons become common. • Trilobites and corals flourish in the oceans. • Lungfish develop. • First amphibians reach land.	• Great swamp forests of huge, woody trees cover eastern North America and parts of Europe. • First true reptiles appear. • Winged insects appear.		• Reptiles become dominant on land. • Warm-blooded reptiles appear. • Mass extinction of many marine inver-tebrates, including trilobites.
Shark	Cockroach	Dragonfly	Dimetrodon
Bony fish	Devonian forest	Amphibian	Coal forest
			Conifer
			Dicynodon

Paleozoic Fossils

Early Amphibian

Early Shelled Organism

Jawless Fish

Trilobite

How did the Paleozoic Era End?

- At the end of the Paleozoic Era 90% of the ocean animals and 70% of the land animals became extinct.

Talk With Your Group!

- Predict why there was a mass extinction at the end of this period.
  - Come up with at least two possible reasons.

How did the Paleozoic Era End?

- Perhaps, as Pangaea formed, changes to the ocean and land caused species to die,
- Another theory is that massive volcanic eruptions lead to the death of these species.

The Mesozoic Era

- 248 – 65 million years ago
- What did the Earth Look Like?
  - Pangaea begins to break up
  - The climate became very dry
- What types of life existed?
  - Reptiles were able to survive the mass extinctions at the end of the Paleozoic Era.
  - Age of the Dinosaurs
  - Early birds, bony fish, and small mammals
  - More modern plants

Mesozoic Era
245–66 million years ago

Triassic
245–208 million years ago

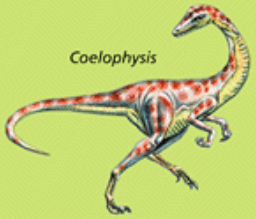
Geologic Events

- Pangaea holds together for much of the Triassic.
- Hot, dry conditions dominate the center of Pangaea.

Development of Life

- Age of Reptiles begins.
- First dinosaurs appear.
- First mammals, which evolve from warm-blooded reptiles, appear.
- First turtles and crocodiles appear.
- Conifers, palmlike trees, and ginkgo trees dominate forests.


Megazostrodon


Coelophysis


Cycad

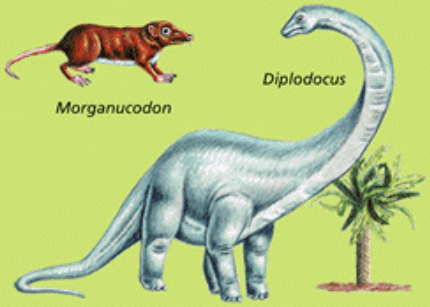
Jurassic
208–144 million years ago

- Pangaea breaks apart as North America separates from Africa and South America.


Archaeopteryx

- Largest dinosaurs thrive, including *Stegosaurus*, *Diplodocus*, and *Apatosaurus*.
- First birds appear.
- First flying reptiles, pterosaurs, appear.

Morganucodon


Diplodocus

Cretaceous
144–66 million years ago

Geologic Events

- Continents move toward their present-day positions, as South America splits from Africa.
- Widespread volcanic activity occurs.

Development of Life

- First flowering plants appear.
- Dinosaurs, including *Tyrannosaurus rex*, dominate.
- First snakes appear.
- Mass extinction at end of period causes disappearance of many land and marine life forms, including dinosaurs.


Tyrannosaurus rex


Creodonts

Mesozoic Reptiles (Dinosaurs!)

Other Mesozoic Fossils

Early Amphibian

Early Bony Fish

Early Mammal

Talk With Your Group!

- What do you already know about how the dinosaurs died?

How did the Mesozoic Era End?

- Most Land and Ocean species became extinct. (The dinosaurs disappeared)
- Possibly, a huge asteroid hit the Earth causing the mass extinction.
  - The impact put a huge cloud of dust in the atmosphere blocking out the sunlight. Without sunlight plants died as well as the animals that fed on plants……

The Cenozoic Era

- 65 million years ago until the present!
- What did the Earth Look Like?
  - Mountain ranges in North and South America formed
  - Modern grasslands formed
  - The climate became cooler (The Ice Age occurred during part of this era.)
- What types of life existed?
  - During the Ice age: Mammoths, Saber Tooth Tigers etc. (became extinct after the Ice Age)
  - Grazing animals arrived: horses, rhinos, etc.
  - Modern mammals, birds, reptiles, fish, amphibians
  - Modern plants

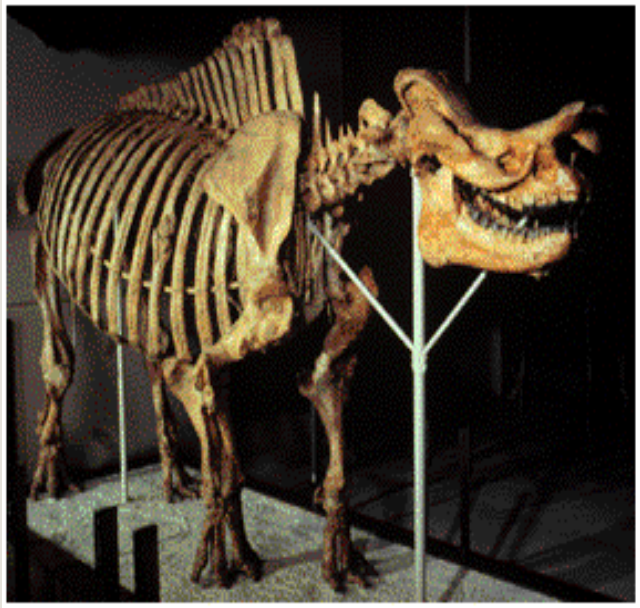
Cenozoic Era

66 million years ago to present

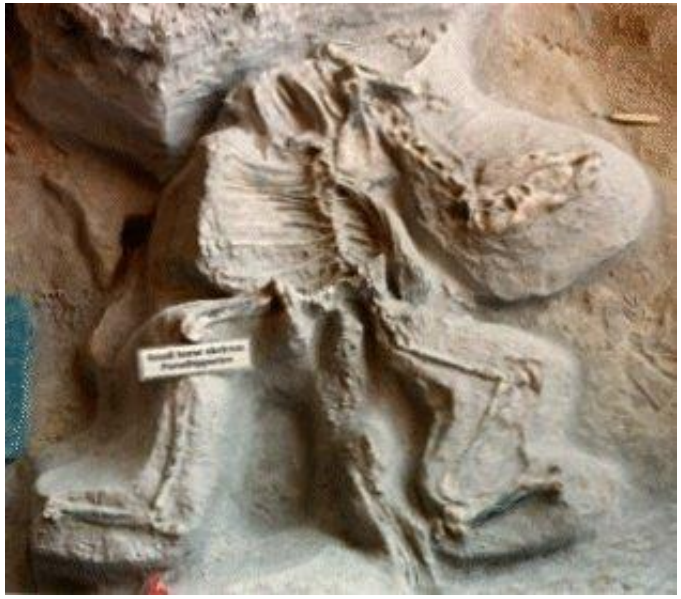
Tertiary	Quaternary
66–1.8 million years ago	1.8 million years ago to the present
• The Rocky Mountains and Himalayas form. • Continents continue to move into present-day positions. • Continental glacier covers Antarctica.	• Thick glaciers advance and retreat over much of North America and Europe, parts of South America and Asia, and all of Antarctica.
	
agnolia • Flowering plants thrive. • First grasses appear. • Age of Mammals begins. • Modern groups such as horses, elephants, bears, rodents, and primates appear. • Ancestors of humans evolve.	• Mammals, flowering plants, and insects dominate land. • Modern humans evolve in Africa about 100,000 years ago. • Giant mammals of North America and Eurasia become extinct when the Ice Age ends about 10,000 years ago.
 *Uintatherium*  *Plesiadapis*  *Hyracotherium*	 *Megatherium*  *Homo sapiens*

Ice Age Animals

Grazing Animals



Early Rhino



Early Horse

Making Connections…

- Why do you think the Cenozoic Era has not ended?