

Objectives

After reading this lesson, you should be able to

- ◆ describe the geologic time scale.
- ◆ summarize events that occurred during each era of geologic time.

Geologic time scale

Outline of the events of the earth's history

Precambrian Era

Oldest and longest era of the earth's history; began about 4.6 billion years ago and ended about 540 million years ago

We know the earth has changed over time. But how the earth actually began is still a big question. Scientists use the evidence they have to suggest theories about the earth's origin.

Using evidence from the rock record and fossil record, scientists have developed the **geologic time scale**, shown on page 348. The geologic time scale is an outline of major events in the earth's history. Find the four major units, or eras, of geologic time. Notice how eras are divided into smaller units called periods. Some periods are divided into even smaller units called epochs. Refer to this table as you read about each era.

The Precambrian Era

The **Precambrian Era** is the oldest and longest era. It accounts for about 85 percent of all geologic time. The Precambrian Era began with the formation of the earth and ended about 540 million years ago.

Most Precambrian rocks are igneous or metamorphic. They form the foundation of the continents. These ancient rocks are exposed in some areas where the earth's crust has lifted and eroded. Precambrian rocks can be seen in the Black Hills of South Dakota, the Appalachian Mountains in the eastern United States, and the Ozark Mountains of Missouri.

Simple organisms probably first appeared at least 3.5 billion years ago, early in the Precambrian Era. These organisms may have included relatives of algae, fungi, and bacteria. The fossil record contains limited evidence of Precambrian organisms.

The Geologic Time Scale

Era	Period	Epoch	Years Before the Present (approximate)		Forms of Life	Physical Events
			Began	Ended		
Cenozoic	Quaternary	Recent	11,000		Humans dominate	West Coast uplift continues in U.S.; Great Lakes form
		Pleistocene	2,000,000	11,000	Primitive humans appear; mammoths	Ice age
	Tertiary	Pliocene	7,000,000	2,000,000	Modern horse, camel, elephant develop	North America joined to South America
		Miocene	23,000,000	7,000,000	Grasses; grazing animals thrive	North America joined to Asia; Columbia Plateau
		Oligocene	38,000,000	23,000,000	Mammals progress; elephants in Africa	Himalayas start forming; Alps continue rising
		Eocene	53,000,000	38,000,000	Ancestors of modern horse, other mammals	Coal forming in western U.S.
		Paleocene	65,000,000	53,000,000	Many new mammals appear	Uplift in western U.S. continues; Alps rising
Mesozoic	Cretaceous		145,000,000	65,000,000	Dinosaurs die out; flowering plants	Uplift of Rockies and Colorado Plateau begins
	Jurassic		208,000,000	145,000,000	First birds appear; giant dinosaurs	Rise of Sierra Nevadas and Coast Ranges
	Triassic		245,000,000	208,000,000	First dinosaurs and mammals appear	Palisades of Hudson River form
Paleozoic	Permian		280,000,000	245,000,000	Trilobites die out	Ice age in South America; deserts in western U.S.
	Pennsylvanian		310,000,000	280,000,000	First reptiles, giant insects; ferns, conifers	Coal-forming swamps in North America and Europe
	Mississippian		345,000,000	310,000,000	Early insects	Limestone formation
	Devonian		395,000,000	345,000,000	First amphibians appear	Mountain building in New England
	Silurian		435,000,000	395,000,000	First land animals (spiders, scorpions)	Deserts in eastern U.S.
	Ordovician		500,000,000	435,000,000	First vertebrates (fish)	Half of North America submerged
	Cambrian		540,000,000	500,000,000	Trilobites, snails; seaweed	Extensive deposition of sediment in inland seas
Precambrian			4,600,000,000	540,000,000	First jellyfish, bacteria, algae	Great volcanic activity, lava flows, metamorphism of rocks; evolution of crust, mantle, core

Paleozoic Era

Era marked by great development in sea life; began about 540 million years ago and ended about 245 million years ago

Science Myth



Some science-fiction books and movies portray people and dinosaurs living at the same time.

Fact: Most scientists believe that dinosaurs existed from the Triassic Period through the Cretaceous Period. This was between 245 and 65 million years ago. People appeared about 2 million years ago, which was long after the dinosaurs disappeared.

The Paleozoic Era

The **Paleozoic Era** began about 540 million years ago and ended about 245 million years ago. It was a time of great development of life in the oceans. At times, oceans covered large portions of the continents. Paleozoic rocks contain fossils of trilobites, sponges, and shellfish. The first land plants and animals also developed during this era. In the geologic time scale on page 348, note the progression of life from amphibians to insects to reptiles. Many ancient insects were huge. Some dragonflies had the wingspan of eagles!

During the Paleozoic Era, the earth's crust underwent many changes. For example, the Appalachian Mountains formed during this time as the crust buckled over millions of years. Much of the coal, oil, and natural gas we use today for energy formed from the organisms that lived in large swamps and shallow seas during this era. Many rock layers built up over the dead organic matter. Heat and pressure slowly turned the organic matter into coal, oil, and natural gas.



Compare the trilobite model above with the fossils shown on page 336.

Mesozoic Era

Era characterized by dinosaurs; began about 245 million years ago and ended about 65 million years ago

The Mesozoic Era

The **Mesozoic Era** began about 245 million years ago and ended 65 million years ago. Life on land flourished during this time. Trees similar to our palm and pine trees were common. Small mammals and birds first appeared. But this era is often called the Age of Reptiles because they were the major form of life on land. The most dominant of the reptiles were the dinosaurs.

In many ways, the kinds of dinosaurs were like the kinds of animals today. Some ate meat and some ate plants. Some were larger than an elephant, while others were as small as a chicken. Some were fierce and others were gentle. Some traveled in herds and some were loners. Even their color probably varied, though we cannot tell this from the fossil record.

The end of the Mesozoic Era is marked by the end of the dinosaurs. Why the dinosaurs died out, or became extinct, during this time is still a mystery.



Did You Know?

Scientists have considered many theories to explain why the dinosaurs died out. One theory suggests that dinosaurs became extinct after a huge asteroid or comet hit the earth. The dust from the impact may have blocked out the sun for months. Plants would have died, as would have the plant-eating dinosaurs. Then dinosaurs that ate the plant-eaters would have died. A gigantic crater discovered in 1990 in the Gulf of Mexico supports this theory.



This is a fossil model of the largest Tyrannosaurus rex skeleton ever discovered. It is displayed at The Field Museum in Chicago.

Cenozoic Era

Era described as the Age of Mammals; began about 65 million years ago and continues today



Did You Know?

If you compared the earth's entire history to a one-year calendar, the Precambrian Era would be the first $10\frac{1}{2}$ months. Dinosaurs would appear around December 12 and become extinct by December 27. The first humans would show up during the last few hours of New Year's Eve.

The Cenozoic Era

We are living in the **Cenozoic Era**. It began about 65 million years ago. During this era, the Alps and the Himalayas formed as the earth's plates continued to collide. Late in the era, several ice ages occurred. An ice age is a period of time when glaciers cover large portions of the land. About 2 million years ago, glaciers carved out huge basins and formed the Great Lakes.

Although dinosaurs became extinct at the close of the Mesozoic Era, mammals survived and flourished. The Cenozoic Era is known as the Age of Mammals. In this era, mammals, including humans, became the dominant form of life. The variety of mammals grew. The population, or total number, of each kind of mammal grew as well. At the same time, the kinds and numbers of birds, reptiles, fish, insects, and plants also increased.

Scientists estimate that about 30 million kinds of animals and plants live on the earth today. This is a small percent of all the kinds of organisms that have ever existed. Scientists also believe that about 100 kinds of organisms become extinct each day. Two factors that threaten the survival of plants and animals are pollution and the destruction of the natural environment. Many people are working to save animals and plants from extinction.

As time continues, living things and the earth that supports them will continue to change.



Technology Note

Scientists use fossils to find the ages of rocks. Scientists also use fossils to find deposits of oil. Some fossils, called conodonts, were formed in a variety of colors. The colors are related to how hot the rock was when the fossil formed. This is important because oil forms underground only at certain temperatures. The colors of the conodonts, then, help scientists locate rock layers that might contain oil.

Eras in the Geologic Time Scale: Terms Review

Directions Match each term with its description. Write the letter of the correct description on the line.

_____ 1. principle of superposition

_____ 2. Paleozoic Era

_____ 3. geologic time scale

_____ 4. fossil

_____ 5. radioactive element

_____ 6. index fossil

_____ 7. principle of crosscutting relationships

_____ 8. petrification

_____ 9. half-life

_____ 10. Mesozoic Era

A era marked by trilobites and other sea life

B youngest feature cuts across other rock layers

C fossil that provides clues to the age of a rock

D element that decays to form another element

E outline of the earth's history

F dinosaur era

G oldest rock layer is on the bottom

H minerals replace a buried organism

I preserved remains of an organism

J length of time for half of an element's atoms to decay

Directions 11–18. In each box below, write the numbers 1 to 4 on the lines to show the correct order in geologic history.

_____ Paleozoic Era

_____ Cenozoic Era

_____ Precambrian Era

_____ Mesozoic Era

_____ Swamps form; coal begins to develop.

_____ The earth's crust and mantle form.

_____ The Rocky Mountains form.

_____ The Great Lakes form after the last ice age.

Directions Contrast each pair of terms. Explain how the terms in each pair are different.

19. absolute dating—relative dating _____

20. cast—mold _____
