

Cenozoic Era — (“Current Time”) The current era, beginning about 65 million years ago with the extinction of the dinosaurs and marked by the dominance of mammals.

Discussion Topics

- Discuss how our information about the history of the Earth and its organisms continues to become more accurate as technology improves.
- Discuss how the geography of Pangaea and Gondwanaland could have contributed to the extinction of species.
- Given what you know about the Earth's processes of continental shift and formation, predict what the Earth will look like in a few million years.

Focus Questions

1. How long ago do geologists believe the Earth was formed?
2. How do we know about events that occurred billions of years ago?
3. Describe the innovation of trilobites.
4. How were cockroaches used for medicinal purposes in the 16th century?
5. What is the difference between amphibians and reptiles?
6. When did mammals become the dominant life form on Earth?
7. What are some survivors from the Age of Dinosaurs?
8. What creatures did Charles Darwin study? What did he theorize after observing these organisms?

Activities

- The numbers involved in geological time scale are staggering. Using the geological time scale calculator at the following web site, have the class create their own metaphors for geologic time: www.athro.com/geo/hgframe.html. For example, the history of time could be the distance from the classroom to the other end of the hall. As a group, develop an illustrated time line, marking off the eras and periods and placing the major evolutionary events in appropriate places.
- Introduce students to key aspects of evolutionary biology with an emphasis on Darwin's model of natural selection by utilizing the online biology resources located at the Modeling for Understanding in Science Education (MUSE) web site found at www.wcer.wisc.edu/ncisla/muse/naturalselection/intro/index.html.

Internet Resources

Periodically, Internet Resources are updated on our web site at www.libraryvideo.com

- www.ucmp.berkeley.edu/exhibit/geology.html
This online exhibit from the “Geology Wing” at the University of California Museum of Paleontology surveys the history of the Earth, focusing on changes in life through time and the locations where fossils have been found.
- kids.earth.nasa.gov/archive/pangaea/index.html
This page from NASA for kids discusses continental drift and how it is observed by scientists.

Suggested Print Resources

- Knoll, Andrew. *Life on a Young Planet: The First Three Billion Years of Evolution on Earth*. Princeton University Press, Princeton, NJ; 2003.
- Lynch, John. *Walking with Cavemen*. Dorling Kindersley Publishing, New York, NY; 2003.
- Tattersal, Ian and Jeffrey Schwartz. *Extinct Humans*. Westview Press, Boulder, CO; 2001.
- Taylor, Paul. *Fossil*. Dorling Kindersley Publishing, New York, NY; 2000.

TEACHER'S GUIDE

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Prehistoric Life

Grades 4–8

The *Eyewitness DVD Series* explores the natural world with fascinating film footage and nature photography fused with striking special effects and stunning graphics. The programs offer a unique “eyewitness” view of events that shape the Earth and the living things that inhabit it.

Interactive menus allow viewers to easily select and replay any section of a program. Other features include interactive assessment quizzes and “Hotspots” — video icons that appear throughout the program and allow students to further explore specific science content or areas of interest. Each title contains a segment that reveals all the behind-the-scenes wizardry that goes into the production of the *Eyewitness* series, along with recommended web sites for further research.

Included in this guide is a brief synopsis of the program, background on the science concepts presented in the show, discussion topics, activities, vocabulary and additional resources for students to explore.



Background

How do we know about the Earth's history? When did the world begin and what was it like? Humans have always sought to explain these mysteries. Ancient storytellers told creation myths of nothingness and chaos that existed before the Universe was born. In the 17th century, scholars looked to the Bible for data and estimated that the Earth was created in 4004 BCE. Less than one hundred years later, the first geologists found clues that the Earth was much older and argued that its age should be calculated not in thousands, but in millions of years. The evidence now points to the history of the Earth covering a much longer time — billions of years, in fact!

Since humans have only been on the Earth for a tiny fraction of that time, scientists study fossils to gain clues about the history of the Earth and its inhabitants. Various scientific techniques are used to interpret these clues and determine the age of fossils. One method for dating fossils results from an analysis of the radioactive decay of chemical elements over time. Through the study of fossils, scientists are able to guess what the Earth, its climate and its ancient living organisms looked like in the distant past, and how they have changed over the course of Earth's history. But the fossil record is incomplete. Of all the life forms ever to exist, 99% are now extinct, and most extinct species left no fossil evidence behind! New scientific techniques continue to be developed, though, and scientists constantly learn more about our world.

We can now estimate the Earth's age as 4.6 billion years, and it seems that for most of those years, there was no life at all. The Earth was a molten ball of gas and chemicals. Then, perhaps triggered by lightning or by ultraviolet light, organic chemical compounds began to link together and form proteins. Proteins grew and split, and life was launched. As the Earth cooled over millions and millions of years, condensed water vapor fell as rain, filling up valleys and canyons, and creating the oceans. Eventually, primitive microscopic bacteria appeared and began to fill the atmosphere with oxygen. Ancient creatures, like jellyfish, developed. On dry land, primitive plants colonized and soon after, arthropods joined them.

Meanwhile, in the oceans, the Age of Fishes had begun. Eventually, some fish developed lungs, enabling them to emerge from shallow water and breathe. Amphibians had made landfall. Next came flying insects like the cockroach, and from amphibians developed reptiles. Next came the Age of the Dinosaurs, a period that lasted for around 160 million years. Along with familiar creatures like Tyrannosaurus rex, flying reptiles like the giant pterosaur and small mammals made their debut.

The end of the dinosaurs occurred 65 million years ago. Possibly a massive meteorite, climatic change, or even cancer caused by radiation from a collapsing star led to the demise of these creatures and eventually to the domination of mammals.

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Millions of years after the dinosaurs, weird and wonderful creatures still walked the earth — or found other means of travel, with features that were scrambled in surprising combinations. By 50 million years ago, the continents were nearly as they are today, but were still traveling. India crashed into Asia, creating the Himalayas which are still rising today, and Antarctica headed south, into its deep freeze. The stage was set for the emergence of a mammal that would find entirely new ways to occupy every corner of the planet...humans. "Homo sapiens" have come a long way, yet only in the latest blink on Earth's time scale. And new discoveries are constantly being made!

Vocabulary

Big Bang Theory — A theory of the history of the universe in which the expansion of the universe is presumed to have begun with an explosion.

Charles Darwin (1809–1882) — English naturalist who originated the theory of evolution by natural selection.

Australopithecus afarensis — A hominid species that lived from approximately 4 to 2.7 million years ago in Africa. Possibly the best-known specimen is "Lucy," a partial skeleton found in November 1974 at Hadar, Ethiopia, thought to be over a 3 million years old.

coelacanth — A primitive fish that appeared about 380 million years ago and was thought to be extinct until living specimens were discovered in the Indian Ocean.

Dunkleosteus — A heavily-armored primitive fish from the Late Devonian period, living about 400 million years ago.

fossil — (from Latin, meaning "to dig") Preserved evidence of living things that previously existed on the Earth, often found deep inside rock, peat, tar, ice or golden amber. The science of studying fossils is called paleontology.

Gondwanaland — A southern supercontinent composed of all the present-day southern continents and India, formed during the Jurassic period when Pangaea broke into two parts.

Hallucigenia — A strange looking type of 'velvet worm' with tentacles and spikes that lived during the Cambrian period (nearly 540 million years ago).

hominid — The scientific family that consists of human beings and early humanlike ancestors.

Homo sapiens — (from Latin, meaning "wise person") Early modern humans thought to have evolved between 150,000 and 200,000 years ago in Africa.

Neanderthals — Ancient humans first discovered in 1856 in the Neander Valley in Germany. The Neanderthals lived in Europe and central Asia between 230,000 and 30,000 years ago.

Pangaea — The gigantic supercontinent that existed 200 million years ago when all the Earth's continents were joined together in one huge land mass.

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prehistory — The time period before the beginning of written language.

Symbion pandora — An unusual marine organism the size of a period that can be found in great numbers attached to lobsters' lips. This creature was discovered by Danish biologists in 1995.

trilobites — Hard-shelled, segmented creatures that existed over 300 million years ago (from the start to the end of the Paleozoic era) in the Earth's ancient seas. These arthropods developed one of the first advanced visual systems (a set of compound eyes) in the animal kingdom.

Precambrian — The longest segment of the Earth's history, lasting from around 4.6 billion years ago to 570 million years ago.

Paleozoic Era — ("Ancient Time") The segment of geological time following the Precambrian, lasting for 345 million years. During this era, the evolution of life accelerated rapidly. This era consists of six smaller segments called periods.

Cambrian Period — The first period of the Paleozoic Era, lasting from around 550 to 500 million years ago, when primitive marine organisms lived in the Earth's warm, shallow oceans.

Ordovician Period — The second period of the Paleozoic Era, lasting 70 million years. During this time, primitive fish appeared and volcanic eruptions were common.

Silurian Period — The third period of the Paleozoic Era, during which mountain ranges pushed up from the sea and plants began to appear on land. Bony fish developed in the ocean.

Devonian Period — The fourth period of the Paleozoic Era, when insects and amphibians developed and moved to swampy forests.

Carboniferous Period — The fifth period of the Paleozoic Era, around 350 million years ago, when flying insects and reptiles evolved. During this time, vast sheets of ice covered large sections of the Earth.

Permian Period — The sixth and final period of the Paleozoic Era, during which time amphibians, reptiles and giant ferns flourished.

Mesozoic Era — ("Middle Time") One of the major divisions of geological history, following the Paleozoic Era and preceding the Cenozoic Era. It is known as the Age of the Dinosaurs and lasted for 160 million years. This era consists of three periods.

Triassic Period — The first period of the Mesozoic Era, when both dinosaurs and tiny mammals began to appear.

Jurassic Period — The second period of the Mesozoic Era, when dinosaurs ruled the Earth.

Cretaceous Period — The third period of the Mesozoic Era, when flowering plants appeared and dinosaurs abruptly disappeared.

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