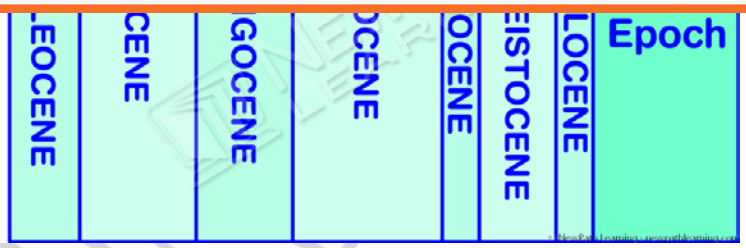
GEOLOGIC TIME

Scientists have determined that the **absolute age** of the Earth is 4.6 billion years. The ability to determine the age of rocks in specific years has only been possible in recent years. However, from the earliest days of the science of geology, geologists have understood Earth's history in terms of **relative time**. They established a system of divisions and subdivisions to categorize rocks and Earth's history into understandable segments.

The Geologic Time Scale

The **geologic time scale** is a map that divides Earth history into logical segments of time. The oldest segment of time appears at the bottom of the scale and the most recent time period is at the top of the scale. The divisions on the scale mark significant transitions in Earth's history. Most often, these transitions represent important, and sometimes dramatic, changes in the life forms present on Earth and significant changes in geologic history. For example, the **Paleozoic era** repres plants and trees, inse ents more complex li g reptiles, and early

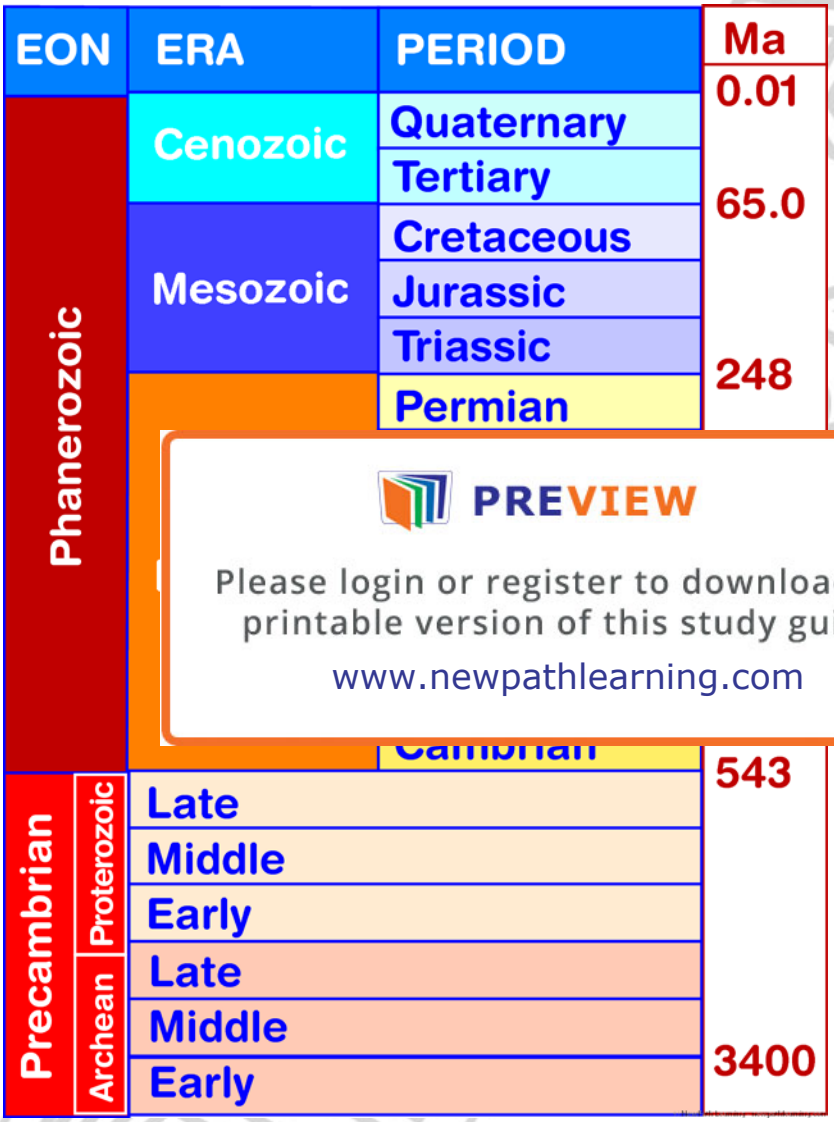


It is important for Earth science students to learn the Geologic Time Scale since all professional geologists refer to this to describe when geologic events occurred, when life forms existed, and so on. Modern geologists also know the absolute dates associated with the relative times listed in the time scale.

Lesson Checkpoint:
Why did early geologists create the divisions of geologic time?

Divisions and Subdivisions

The geologic time scale is broken into divisions and subdivisions. The broadest divisions are called **eons**. Eons are divided into **eras**, eras are divided into **periods,** and periods are divided into **epochs**. For example, the Pleistocene is an epoch in the Quaternary period in the Cenozoic era in the Phanerozoic eon.



There are two Eons. **Precambrian** simply refers to the time before the Cambrian Period. **Phanerozoic** is derived from two Greek words that literally mean "visible life." The names of the eras simply make reference to the life forms found in those eras. **Paleozoic** literally means "ancient life." **Mesozoic** means "middle life." **Cenozoic** means "recent life." The Period names are, for the most part, derived from the regions which were first studied and described by geologists.

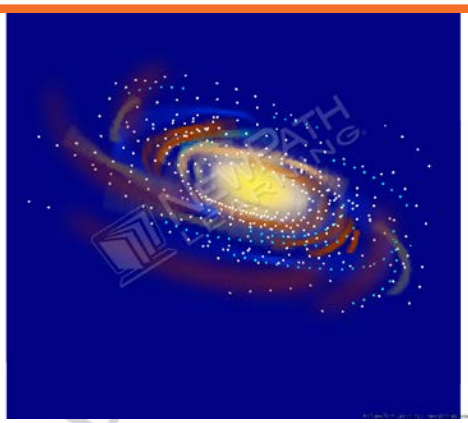
The Cambrian period, for example, was named after Cambria, England. The ending of the Epoch names, -cene, is derived from the Greek word "kainos" which means "new." Each Epoch represents new life forms with which that Epoch is identified.

This is a very simplified version of the Geologic Time Scale. Through the years, geologists have broken the Geologic Time Scale into smaller and smaller subdivisions. This is the result of increased and more detailed studies of the various strata and rock formations throughout the Earth. For the beginning student, however, this basic time scale presents the essentials.

Lesson Checkpoint:
What does each Epoch represent in the Geologic Time Scale?

The Earth's Formation

The formation of the Earth as a planet took billions of years. The **accretion** ...how the Earth form... in the solar syste... ...ach other and stuck ... ...es. In time larger ... ...nother. They grew ... ...etesimals accreted t... ...ets.



When the Earth was large enough, its own gravitational force caused the separation of the Earth's rocky materials into layers. The **core** is the center of the Earth and is the densest material, nickel and iron. The **mantle** is the next layer, and the thickest. The surface of the Earth is covered by a relatively thin **crust,** which is the least dense of the layers.

The Earth's earliest atmosphere most likely consisted of gases such as water, ammonia and methane. A second atmosphere eventually formed which was composed of sulfur, water and carbon dioxide. The sources of these gases were probably volcanoes and impacts from comets. Approximately 3.9 billion years ago, oxygen first began to accumulate in Earth's atmosphere. The oxygen was produced by photosynthesis from simple organisms like algae.

Lesson Checkpoint:
As the Earth grew into a planet, what caused the separation of the Earth's rocky materials into layers?

The Paleozoic Era

The Paleozoic Era literally means "old life." It lasted from 540 million years ago to 248 million years ago. At the beginning of the Paleozoic (the Cambrian Period), there were only simple life forms. By the end of the Pale ture onto land and ir marked the growth ozoic Era contains th ic fossil record incl rine invertebra s.

The Paleoz ercent of all species. This is known as the **Permo-Triassic Extinction.** This extinction episode was even more destructive than the one that included the extinction of the dinosaurs at the end of the Mesozoic Era.

The Mesozoic Era

The Mesozoic Era literally means "middle life." It lasted from 248 million years ago to 65 million years ago. This era is most popularly known as "The age of the Reptiles." Some even call it "The age of the Dinosaur." It is during this era that life crawled out of the water and learned to live exclusively on land. Even though the reptiles were the most dominant of animals, early birds and small mammals also began to appear on the landscape.

The end of the Mesozoic Era is marked by another mass extinction. It is estimated that about 50% of all species, including all of the dinosaurs, became extinct at the end of the Mesozoic. There are a number of theories proposed to explain this extinction, but the most commonly accepted is the theory that an enormous meteorite struck the Earth and created a cloud of smoke and dust that blocked the sunlight. The extended period of darkness led to the death of plants that in turn led to the starvation of the animals.

Lesson Checkpoint:
What is the most commonly accepted theory about how the Mesozoic Era ended?

The Cenozoic Era

The Cenozoic Era literally means "recent life." It began 65 million years ago and continues to the present day. Let your family and friends know that we live in the Cenozoic Era! This era is most commonly
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Lesson Checkpoint:
What era do we live in now? What is it commonly called?