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# 11.2 The Paleozoic Era

## INQUIRY

### What animal was this?

Imagine going for a swim and meeting up with this Paleozoic monster. *Dunkleosteus* (duhn kuh! AHS tee us) was one of the largest and fiercest fish that ever lived. Its head was covered in bony armor 5 cm thick—even its eyes had bony armor. It had razor-sharp teethlike plates that bit with a force like that of present-day alligators.

Write your response in your interactive notebook.



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# Explore Activity

## What can you learn about your ancestors?

Scientists use fossils and rocks to learn about Earth's history. What could you use to research your past?

### Procedure

1. Write as many facts as you can about one of your grandparents or other older adult family members or friends.
2. What items, such as photos, do you have that can help you?

### Think About This

1. If you wanted to know about a great-great-great grandparent, what clues do you think you could find?

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2. How does knowledge about past generations in your family benefit you today?

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3. How do you think learning about distant relatives is like studying Earth's past?

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### Essential Questions

- What major geologic events occurred during the Paleozoic era?
- What does fossil evidence reveal about the Paleozoic era?



### Vocabulary

- Paleozoic era
- Mesozoic era
- Cenozoic era
- Inland sea
- coal swamp
- supercontinent

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## Discover

Before reading this lesson, write down what you already know in the first column. In the second column, write down what you want to learn. After you have completed this lesson, write down what you learned in the third column.

What I Know	What I Want to Learn	What I Learned
	Phanerozoic Eon: ① Paleozoic (oldest) ② Mesozoic (middle) ③ Cenozoic (youngest)	

## Word Origin

**Paleozoic** from Greek *palai*, means "ancient"; and Greek *zoe*, means "life"

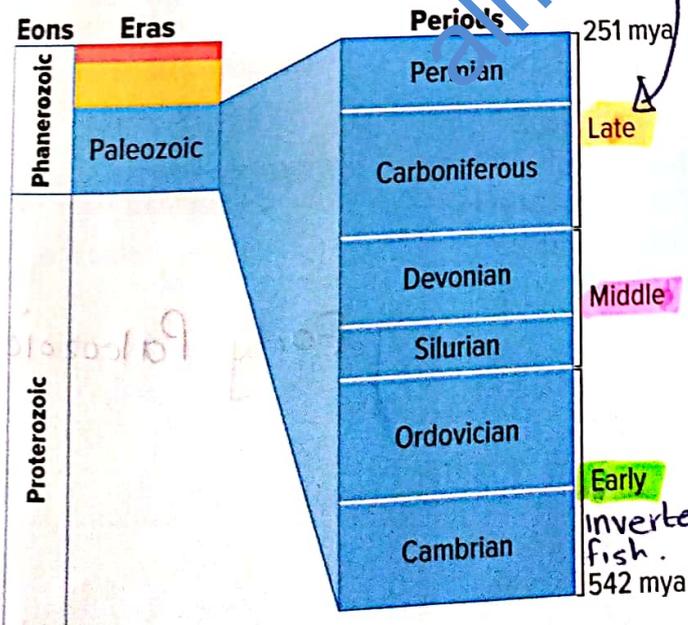
## Early Paleozoic

In many families, three generations—grandparents, parents, and children—live closely together. You could call them the old generation, the middle generation, and the young generation. These generations are much like the three eras of the Phanerozoic eon. The **Paleozoic** (pay lee uh ZOH ihk) **era** is the oldest era of the Phanerozoic eon. The **Mesozoic** (mez uh ZOH ihk) **era** is the middle era of the Phanerozoic eon. The **Cenozoic** (sen uh ZOH ihk) **era** is the youngest era of the Phanerozoic eon.

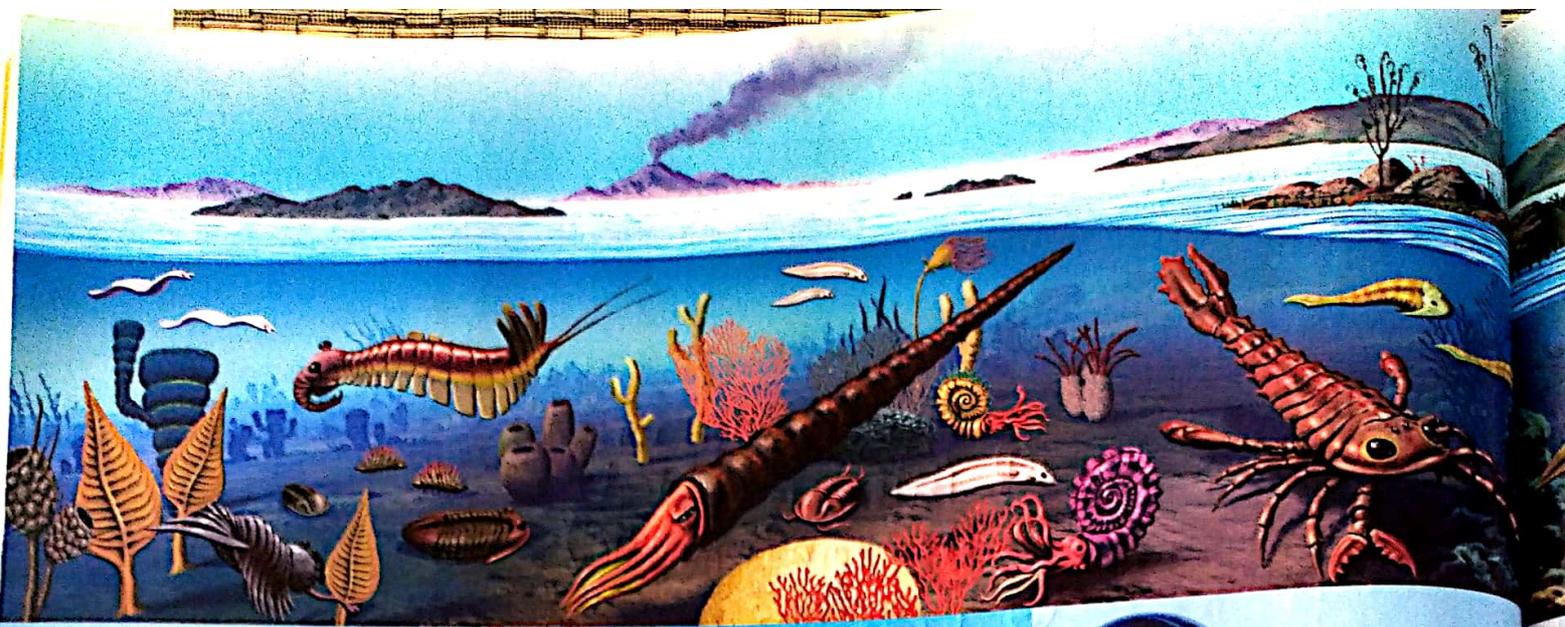
As shown in **Figure 7**, the Paleozoic era lasted for more than half the Phanerozoic eon. Because it was so long, it is often divided into three parts: **early**, **middle**, and **late**. The Cambrian and Ordovician periods make up the Early Paleozoic.

## The Age of Invertebrates <sup>animals with no backbone</sup>

The organisms from the **Cambrian explosion** were **invertebrates** (ihn VUR tuh brayts) that **lived only in the oceans**. Invertebrates are animals without backbones. So many kinds of invertebrates lived in Early Paleozoic oceans that this time is often called the age of invertebrates.



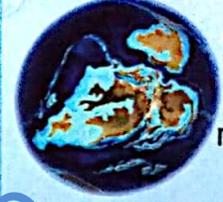
**Figure 7** The Paleozoic era lasted for 291 million years. It is divided into six periods.



**Cambrian Period**  
542 – 488 million years ago



**Ordovician Period**  
488 – 444 million years ago



**Silurian Period**  
444 – 416 million years ago

Figure 8 Earth's continents and life-forms changed dramatically during the Paleozoic era.

**Geology of the Early Paleozoic**

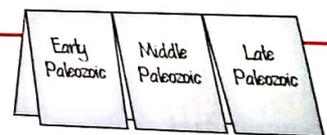
most life was in oceans

If you could have visited Earth during the Early Paleozoic, it would have seemed unfamiliar to you. As shown in Figure 8, there was no life on land. All life was in the oceans. The shapes and locations of Earth's continents also would have been unfamiliar, as shown in Figure 9. Notice that the landmass that would become North America was on the equator.

Earth's climate was warm during the Early Paleozoic. Rising seas flooded the continents and formed many shallow inland seas. An inland sea is a body of water formed when ocean water floods continents. Most of North America was covered by an inland sea.

**FOLDABLES**

Make a horizontal, three-tab book. Label it as shown. Use your book to record information about changes during the Paleozoic Era.



**Visual Check**

1. In what period did life first appear on land?

Early Paleozoic

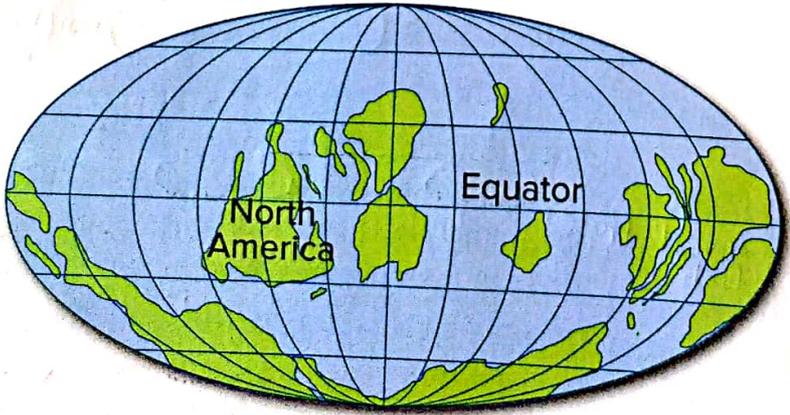
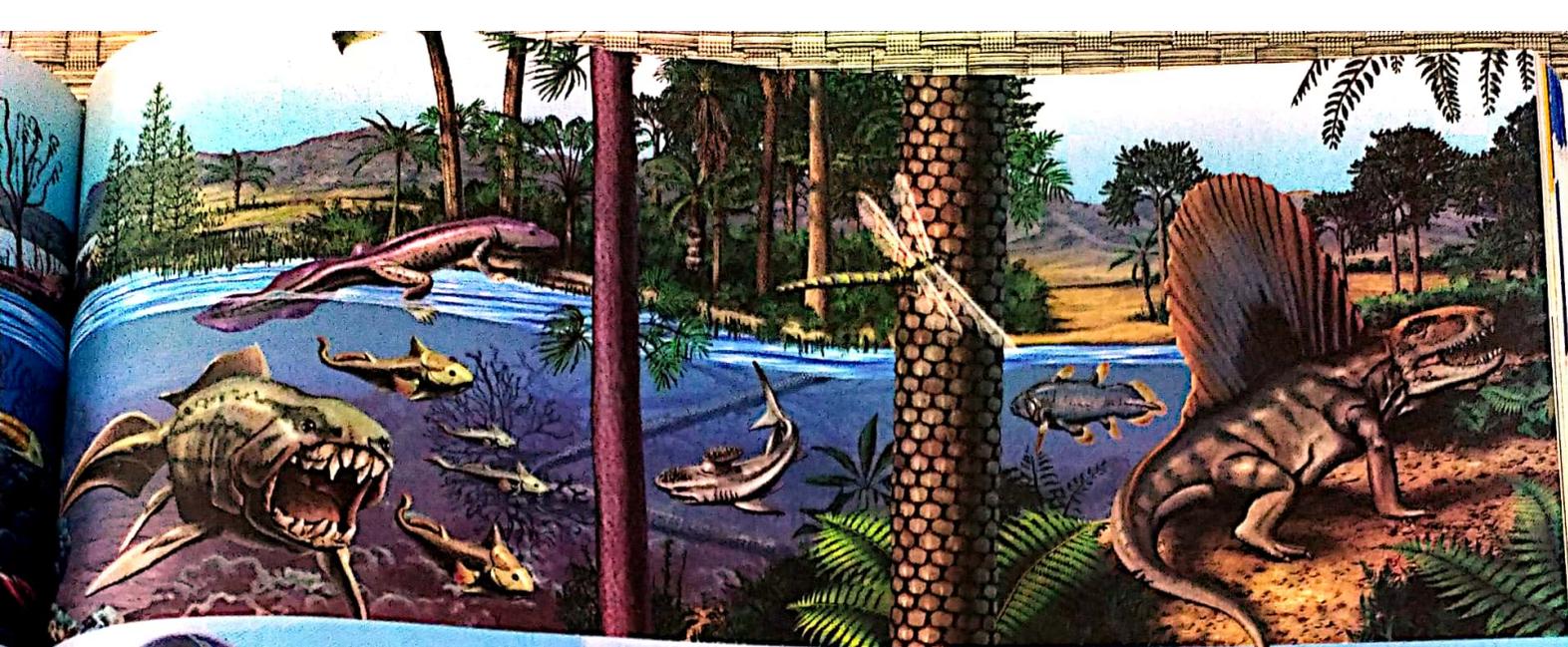
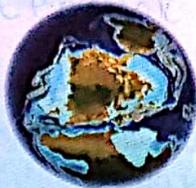


Figure 9 During the Early Paleozoic, North America straddled the equator.



**Devonian Period**  
416 – 359  
million years ago



**Carboniferous Period**  
359 – 299  
million years ago



**Permian Period**  
299 – 251  
million years ago

### Key Concept Check

2. How did the Appalachian Mountains form?

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→ emergence of vertebrates.  
**Middle Paleozoic**

The Early Paleozoic ended with a mass extinction event but many invertebrates survived. New forms of life lived in huge coral reefs along the edges of the continents. Soon, animals with backbones, called vertebrates, evolved.

### The Age of Fishes

Some of the earliest vertebrates were fishes. So many types of fishes lived during the Silurian (suh LOOR ee un) and Devonian (dih VOH nee un) periods that the Middle Paleozoic is often called the age of fishes. Some fishes, such as the *Dunkleosteus* pictured at the beginning of this lesson, were heavily armored. **Figure 10** also shows what a *Dunkleosteus* might have looked like. On land, cockroaches, dragonflies, and other insects evolved. Earth's first plants appeared. They were small and lived in water.



**Figure 10** *Dunkleosteus* was a top Devonian predator.

### Geology of the Middle Paleozoic

Middle Paleozoic rocks contain evidence of major collisions between moving continents. These collisions created mountain ranges. When several landmasses collided with the eastern coast of North America, the Appalachian (ap uh LAY chun) Mountains began to form. By the end of the Paleozoic era, the Appalachians were probably as high as the Himalayas are today.

## Late Paleozoic

Like the Early Paleozoic, the Middle Paleozoic ended with a mass extinction event. Many marine invertebrates and some land animals disappeared.

### The Age of Amphibians

In the Late Paleozoic, some fishlike organisms spent part of their lives on land. *Tiktaalik* (tihk TAH lihk) was an organism that had lungs and could breathe air. It was one of the earliest amphibians. Amphibians were so common in the Late Paleozoic that this time is known as the age of amphibians.

Ancient amphibian species adapted to land in several ways. As you read, they had lungs and could breathe air. Their skins were thick, which slowed moisture loss. Their strong limbs enabled them to move around on land. However, all amphibians, even those living today, must return to the water to mate and lay eggs.

Reptile species evolved toward the end of the Paleozoic era. Reptiles were the first animals that did not require water for reproduction. Reptile eggs have tough, leathery shells that protect them from drying out.

### Coal Swamps

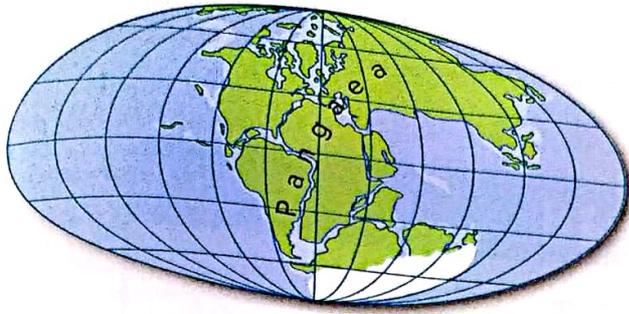
During the Late Paleozoic, dense, tropical forests grew in swamps along shallow inland seas. When trees and other plants died, they sank into the swamps, such as the one illustrated in Figure 11. A coal swamp is an oxygen-poor environment where, over time, plant material changes into coal. The coal swamps of the Carboniferous (car buhn IF er us) and Permian periods eventually became major sources of coal that we use today.

#### Key Concept Check

3. How did different species adapt to land?

Figure 11 Plants buried in ancient coal swamps became coal.





**Figure 12** The supercontinent Pangaea formed at the end of the Paleozoic era.

## Formation of Pangaea

Geologic evidence indicates that many continental collisions occurred during the Late Paleozoic. As continents moved closer together, new mountain ranges formed. By the end of the Paleozoic era, Earth's continents had formed a giant supercontinent—Pangaea. A **supercontinent** is an ancient landmass which separated into present-day continents. Pangaea formed close to Earth's equator, as shown in **Figure 12**. As Pangaea formed, coal swamps dried up and Earth's climate became cooler and drier.

### Key Concept Check

4. What does fossil evidence reveal about the end of the Paleozoic era?

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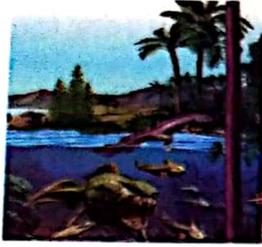
## The Permian Mass Extinction

The largest mass extinction in Earth's history occurred at the end of the Paleozoic era. Fossil evidence indicates that 95 percent of marine life forms and 70 percent of all life on land became extinct. This extinction event is called the Permian mass extinction.

Some scientists hypothesize that a large meteorite impact caused drastic climate change. Others propose that massive volcanic eruptions changed the global climate. Both a meteorite impact and large-scale eruptions would have ejected ash and rock into the atmosphere, blocking out sunlight, reducing temperatures, and causing a collapse of food webs.

# 11.2 Review

## Visualize It!



Life slowly moved to land during the Paleozoic era as amphibians and reptiles evolved.



In the Late Paleozoic, massive coal swamps formed along inland seas.



At the end of the Paleozoic era, a mass extinction event coincided with the final stages of the formation of Pangaea.

## Summarize it!

1. What major geologic events occurred during the Paleozoic era?

- Most land on earth was covered with water.
- Location of continents were not in the same place as they are today.
- Appalachian Mountains formed.
- Formation of pangea.

2. What does fossil evidence reveal about the Paleozoic era?

Fossils of fishes and amphibians were found.

**Use Vocabulary**

1. Distinguish between the Paleozoic era and the Mesozoic era.

Paleozoic era was before the Mesozoic era. Pangea was formed in the Paleozoic era.

2. When ocean water covers part of a continent, a(n) in land sea forms.

3. Use the term *supercontinent* in a complete sentence.

Pangea is a supercontinent.

**Understand Key Concepts**

4. Which was true of North America during the Early Paleozoic?

- A. It had many glaciers.
- B. It was at the equator.**
- C. It was part of a supercontinent.
- D. It was populated by reptiles.

5. Compare ancient amphibians and reptiles and explain how each group adapted to live on land. Amphibians - lungs to breathe, thick skin, strong legs, lay eggs in water

6. Draw a cartoon that shows how the Appalachian Mountains formed.

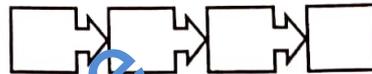
Reptiles: did not lay eggs in water, eggs were tough leathery shells (not hard)

**Interpret Graphics**

7. Organize A time line of the Paleozoic era is pictured below. Copy the time line and fill in the missing periods.

Paleozoic					
Cambrian	Ordovician	Silurian	Devonian	Carboniferous	Permian

8. Sequence Copy and fill in the graphic organizer below. Start with Precambrian time, then list the eras in order.



**Critical Thinking**

9. Consider What if 100 percent of organisms had become extinct at the end of the Paleozoic era?

Life would not have evolved. Only seas and land positioning may have changed.

10. Evaluate the possible effects of climate change on present-day organisms.

Climate change can cause habitat loss → organisms homes destroyed.

Food sources can be affected organisms might die affecting the food chain.