

13.3 Mesozoic Era: Age of Reptiles



Reading Focus

Key Concepts

- What continental movements occurred during the Mesozoic era?
- What plant and animal life dominated the Mesozoic?
- What caused the extinction that marks the end of the Mesozoic?

Vocabulary

- ◆ dinosaur
- ◆ gymnosperm

Reading Strategy

Summarizing List the blue headings from the section, leaving space to write after each heading. Use a bulleted list to write a brief summary of the text for each heading.

I. Mesozoic History

- Begins with most areas above sea level.
- Shallow seas invade most continents.
- _____ ?

Section 13.3

1 FOCUS

Section Objectives

- 13.8** Explain how continental positions changed during the Mesozoic era.
- 13.9** Describe the plant life and animal life that dominated during the Mesozoic era.
- 13.10** State the cause of the mass extinction at the end of the Mesozoic era.

Reading Focus

Build Vocabulary L2

Using Context Clues Encourage students to keep a list of unfamiliar words they encounter while reading. For each word, they should write a definition based on the context and then verify their definition in a dictionary.

Reading Strategy L2

Mountains form in western North America.

2 INSTRUCT

Mesozoic Era

Build Reading Literacy L1

Refer to p. 362D which provides guidelines for using prior knowledge.

Use Prior Knowledge Students learned about plate tectonics and the causes of plate movements in Chapter 9. Ask: **What is happening to the Atlantic Ocean today because of plate tectonics?** (*It continues to widen because of seafloor spreading.*) **What causes seafloor spreading and plate movements?** (*convection currents in the mantle*) **What Earth activity caused the breakup of Pangaea?** (*Tectonic activity/convection currents drove the breakup of Pangaea.*) Verbal

Mesozoic Era

The Mesozoic era spanned about 183 million years, and it is divided into three periods: the Triassic, Jurassic, and Cretaceous. The Mesozoic era marked the beginning of the breakup of the supercontinent Pangaea. During this era, organisms that survived the great Permian extinction began to diversify in amazing ways. On land, **dinosaurs** became dominant and remained unchallenged for over 100 million years.

Mesozoic History The Mesozoic era began with much of the world's land above sea level. In fact, very few marine fossils are found in North America from the Triassic period.

As the Jurassic period gave way to the Cretaceous, shallow seas invaded much of western North America, the Atlantic, and Gulf coastal regions. These shallow seas created great swamps like those of the Paleozoic era, forming Cretaceous coal deposits that are very important economically to the western United States and Canada.

➤ **A major event of the Mesozoic era was the breakup of Pangaea.** Follow this breakup in Figure 11. A rift developed between what is now the eastern United States and western Africa, marking the birth of the Atlantic Ocean and the beginning of the breakup of Pangaea, a process that continued for 200 million years, through the Mesozoic and into the Cenozoic.



For: Links on CAT scanning fossils
Visit: www.SciLinks.org
Web Code: cjn-4133

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Download a worksheet on scanning fossils for students to complete, and find additional teacher support from NSTA SciLinks.

Answer

Predicting Sample answer: Asia's east coast and North America's west coast will be touching since they are moving toward each other, and Australia will be farther north into Asia.

Teacher Demo

Forming the Rocky Mountains

L2

Purpose Students see how deformation of the North American plate could have formed the mountains of western North America.

Materials student textbook, towel slightly wider than the textbook

Procedure Lay the towel flat and slide the textbook just under the short edge of the towel. Then slowly push the textbook toward the towel so that the towel bunches up in front of the book.

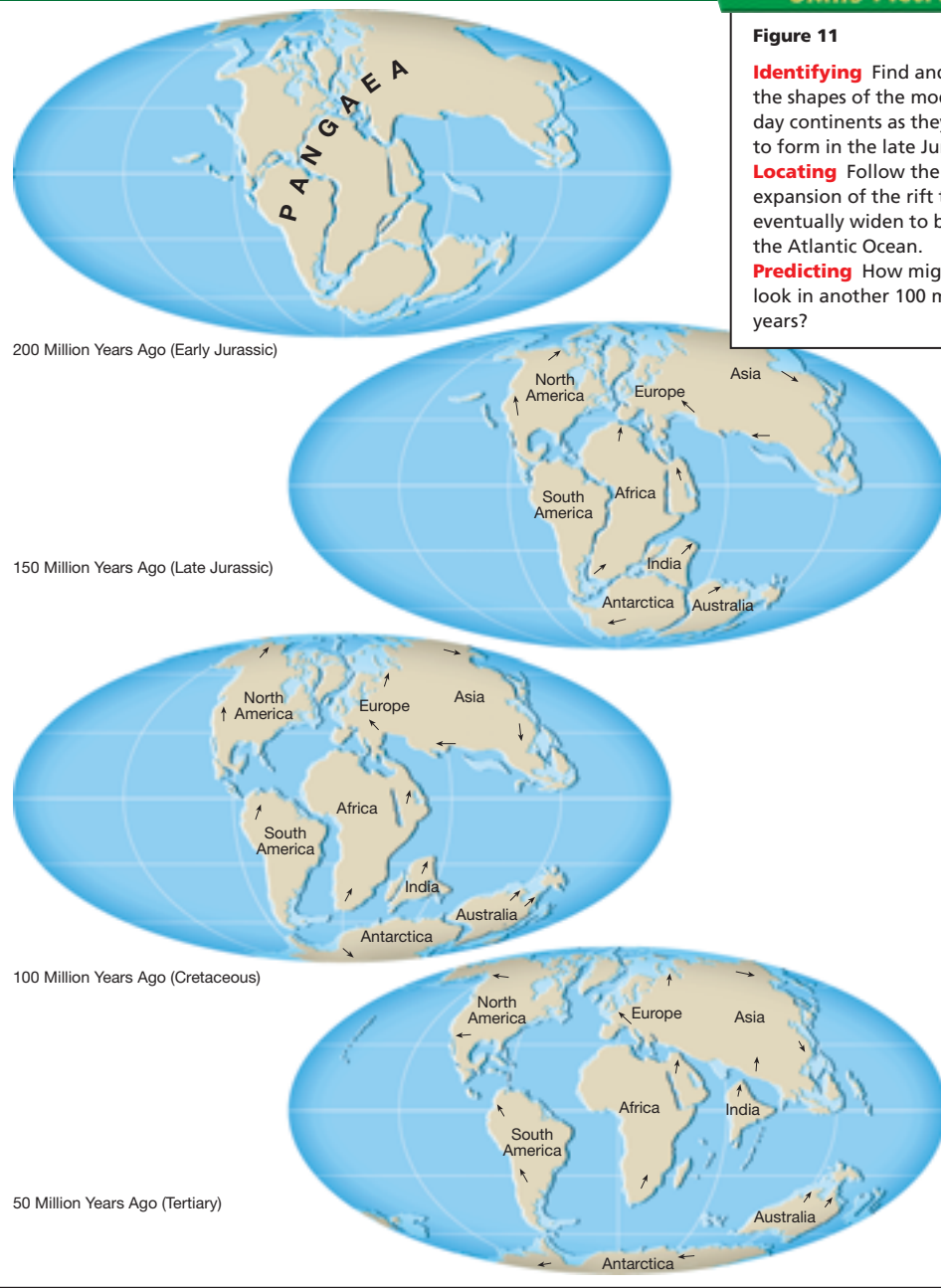
Expected Outcome The towel will form ripples in front of the book, demonstrating the wave of deformation that created the mountains of western North America.

Visual, Kinesthetic

The Breakup of Pangaea

Figure 11

Identifying Find and trace the shapes of the modern-day continents as they start to form in the late Jurassic.
Locating Follow the expansion of the rift that will eventually widen to become the Atlantic Ocean.
Predicting How might Earth look in another 100 million years?



Customize for English Language Learners

In addition to keeping a list of unfamiliar words and defining them based on context, students may also want to write the meaning of the new word in their primary language.

Recommend that students list synonyms for their words instead of dictionary definitions. This will allow students to get a general concept of a word's meaning.

As Pangaea broke apart, the westward-moving North American plate began to override the Pacific plate. Tectonic activity began a continual wave of deformation that moved inland along the entire western part of the continent. The tectonic activity that began in the Jurassic continued throughout the Cretaceous. This activity formed the vast mountains of western North America, like those in Figure 12. Toward the end of the Mesozoic, the ranges of the Rocky Mountains located in Colorado and surrounding states began to form.



Explain how the Atlantic Ocean was formed.

Mesozoic Life When the Mesozoic era began, its life forms were the survivors of the great Paleozoic extinction. These survivors were diversified in many ways and filled the biological emptiness created at the end of the Paleozoic. On land, conditions favored life that could adapt to drier climates. Among plants, the **gymnosperms** were a group of seed-bearing plants that did not depend on free-standing water for fertilization. Unlike the first plants to invade the land, gymnosperms were not restricted to living near the water's edge, and they could take advantage of nutrients and space available in dry areas.

The gymnosperms quickly became the dominant plants of the Mesozoic. Gymnosperm trees included the cycads, the conifers, and the ginkgoes. The cycads resembled a large pineapple plant. The ginkgoes had fan-shaped leaves, much like their modern relatives. The largest plants were the conifers, whose modern descendants include the pines, firs, and junipers.

Figure 12 Mountain ranges such as the Canadian Rockies were formed throughout the Cretaceous.

Relating Cause and Effect
What forces created the mountains?



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Facts and Figures

Some geologists believe there is a supercontinent cycle that repeats itself about every 500 million years. They believe that during this cycle a supercontinent is created by all of Earth's landmasses coming together, and then the supercontinent is broken apart and the

landmasses move away from each other again. Their theory is supported by evidence that a supercontinent called Rodinia broke apart at the end of the Precambrian. Rodinia formed 750 million years ago and broke apart during the late Precambrian and early Proterozoic.

Build Science Skills

L2

Using Models After completing the Teacher Demo above, explain to students that this model represents the deformation of the North American plate that occurred as it overrode the Pacific plate when Pangaea broke up. Ask: **What do the ripples in the towel represent?** (*mountains forming on North America*) **What does the book represent?** (*the Pacific plate*) **How is this model an accurate representation of the interaction between these two plates?** (*Sample answer: The towel is deformed the way land would be and shows the North American plate on top.*) **How is this model inaccurate?** (*Sample answer: Subduction of the Pacific plate would have caused volcanic activity not shown by the model. The actual process took much longer.*) **What would make this model better?** (*Sample answer: The towel should be stiffer, and the top of the book should have a rougher surface to grab the towel as it slides.*)

Visual, Kinesthetic

Answer to . . .

Figure 12 *the tectonic activity that began in the Jurassic and continued throughout the Cretaceous*



A rift developed during the breakup of Pangaea that widened and eventually became the Atlantic Ocean.

Section 13.3 (continued)

Address Misconceptions

L2

Many students think that all large reptiles were dinosaurs. However, dinosaurs are just one particular group of reptiles that share certain characteristics. Use the Build Science Skills activity below to correct this misconception.

Build Science Skills

L2

Classifying Before reading this page, have students write down their definitions of a dinosaur. Then, give each student a set of pictures of large reptiles and dinosaurs such as pterosaurs, crocodilians, iguanas, plesiosaurs, raptors, stegosaurus, sauropods, and mosasaurs. Ask students to determine which pictures are of dinosaurs. After students have made their initial classifications, tell them that all dinosaurs were terrestrial (lived on land) and that none could fly. Also tell students that dinosaurs walked with their legs positioned directly under them, like a dog, bird, or human. Other reptiles walked with their legs sprawled out to the side, like a crocodile. Then, have students reclassify their pictures and determine which are dinosaurs.

Visual, Verbal

The Shelled Egg Among the animals, reptiles readily adapted to the drier Mesozoic environment. They were the first true land animals. Unlike amphibians, reptiles have shell-covered eggs that can be laid on land. The elimination of a water-dwelling stage (like the tadpole stage in frogs) was an important evolutionary step.

Reptiles Dominate 🌍 With the perfection of the shelled egg, reptiles quickly became the dominant land animals. They continued this dominance for more than 160 million years. The dinosaurs were the most awesome of the Mesozoic reptiles. Some of the huge dinosaurs were carnivorous—meat eaters—while others were herbivorous—plant eaters. For example, *Tyrannosaurus* was a carnivorous dinosaur. *Apatosaurus* (formerly *Brontosaurus*) was an herbivore. However, not all dinosaurs were large. Some small dinosaurs resembled the fleet-footed lizards that exist today.

The reptiles made a spectacular adaptation that had already occurred for insects. One group, the pterosaurs, began to fly. These “dragons of the sky” possessed huge membranous wings that allowed them basic flight, as shown in Figure 13. Another group of reptiles, demonstrated by the fossil *Archaeopteryx*, led to more successful flyers—the birds. Whereas some reptiles took to the skies, others returned to the sea, including the fish-eating plesiosaurs and ichthyosaurs. These reptiles became proficient swimmers but retained their reptilian teeth and breathed by means of lungs.



How did reptiles become the dominant land animals?

Figure 13 The flying reptile Pteranodon had a wingspan of 7 meters.



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Facts and Figures

There is a great deal of evidence that a meteorite impact on Mexico's Yucatan Peninsula caused the mass extinction at the end of the Mesozoic. However, there is controversy over this theory partly because tropical plants were barely affected by this extinction event, while plants adapted to a temperate climate were largely destroyed. This does not support the impact theory,

which suggests a large ash cloud blocked the sun, creating an extended winter. If this was the case, then tropical plants should have been more affected since they do not have the dormancy adaptations that temperate plants have. Temperate plants should have had the advantage during this extended winter by being able to go dormant and then come back to life after the crisis.

➡ At the end of the Mesozoic, many reptile groups became extinct. Only a few types of reptiles survived to recent times, including the turtles, snakes, crocodiles, and lizards. The huge land-dwelling dinosaurs, the marine plesiosaurs, and the flying pterosaurs are known only through the fossil record. Most scientists believe that the extinction of these reptiles was caused by a large meteorite that collided with Earth. They believe this collision created huge quantities of dust that blocked out the sun, causing plants to die because they could not turn sunlight into food. Without plants, the huge herbivores could not find enough to eat and eventually could not survive. Then, the carnivores who ate the herbivores could no longer find food. The smaller animals probably survived because they needed less food than the huge dinosaurs.



Figure 14 A fossil skull of a large crocodile—*Sarcosuchus imperator*

Q & A

Q Many dinosaurs were very large. Were they the only large reptiles?

A No. One well-publicized example is a crocodile known as *Sarcosuchus imperator*, shown in Figure 14. This huge river dweller lived in Africa about 110 million years ago during the Cretaceous period. By age 50 or 60, the animal weighed 8 metric tons and was about 12 meters long—as long as *Tyrannosaurus rex* and much heavier. Its jaws were roughly as long as an adult human. This animal has appropriately been dubbed “supercroc.” Paleontologists indicate that the teeth and jaw suggest a diet of large vertebrates, including fish and dinosaurs.

Build Reading Literacy L1

Refer to p. 306D in Chapter 11, which provides guidelines for this KWL strategy.

KWL (Know-Want to Know-Learned) Have students create a KWL chart on the extinction of the dinosaurs. Before reading this page, have students list what they already know about the extinction of the dinosaurs and some things they would like to know. After reading this section, have students complete the last column with what they learned.

Visual, Verbal

3 ASSESS

Evaluate Understanding L2

Put students in cooperative groups and have them answer the Key Concepts questions at the beginning of this section.

Reteach L1

Review content by referring to the summary that each student created for this section’s Reading Strategy. Help students expand on their summaries as needed to make them complete.

Connecting Concepts

Sample answer: As the waters dried up, reptiles needed a way to keep their developing young in a moist environment.

Section 13.3 Assessment

Reviewing Concepts

- ➡ How did plate tectonics create dramatic changes in the continental land mass during the Mesozoic?
- ➡ What advantage allowed both reptiles and gymnosperms to dominate as life forms in the Mesozoic?
- ➡ What caused the extinction of so many of the reptile groups that had flourished?

Critical Thinking

- Comparing and Contrasting** Compare and contrast the physical environment of the Mesozoic era with the Paleozoic.

- Predicting** Why do scientists find so many more fossils from the Mesozoic era than from the Paleozoic?


Connecting Concepts

Hypothesizing The fluid in many eggs is similar to seawater, causing some scientists to refer to shelled eggs as “private aquariums.” Propose a hypothesis on how environmental conditions might cause shelled eggs to develop and allow animals to move onto land.

Section 13.3 Assessment

- Tectonic activity caused the supercontinent of Pangaea to break up during the Mesozoic.
- The advantage of being able to live on land allowed both dinosaurs and gymnosperms to exploit new resources and diversify.
- Scientists think the mass extinction at the end of the Mesozoic was caused by a meteorite impact.
- Paleozoic—mostly land, continents move together to eventually form Pangaea, marked by severe climate change; Mesozoic—the breakup of Pangaea into several separate continents, much more ocean and water
- There are more organisms with hard parts, there are more organisms in general, and the rock layers are less disturbed, weathered, and metamorphosed.

Answer to . . .

 The development of shelled eggs allowed dinosaurs and other reptiles to dominate the land.