

## Earth Science

### **Chapter 9 – A View of Earth’s Past**

#### **Section 3 – The Mesozoic and Cenozoic Eras**

**E.Q.: *What are the major geologic and biologic developments during the Mesozoic and Cenozoic Eras?***

#### **STANDARDS:**

- SES4. Students will understand how rock relationships and fossils are used to reconstruct the Earth’s past.**
- e. Use geologic maps and stratigraphic relationships to interpret major events in Earth history (e.g., mass extinction, major climatic change, tectonic events).**
- SES5. Students will investigate the interaction of insolation and Earth systems to produce weather and climate.**
- f. Relate changes in global climate to variation in Earth/Sun relationships and to natural and anthropogenic modification of atmospheric composition.**
- SES6. Students will explain how life on Earth responds to and shapes Earth systems.**
- d. Describe how fossils provide a record of shared ancestry, evolution, and extinction that is best explained by the mechanism of natural selection.**
  - e. Identify the evolutionary innovations that most profoundly shaped Earth systems: photosynthetic prokaryotes and the atmosphere; multicellular animals and marine environments; land plants and terrestrial environments.**

#### **Objectives**

- List the periods of the Mesozoic and Cenozoic Eras.**
- Identify two major geologic and biological developments during the Mesozoic Era.**

- Identify two major geologic and biological developments during the Cenozoic Era.

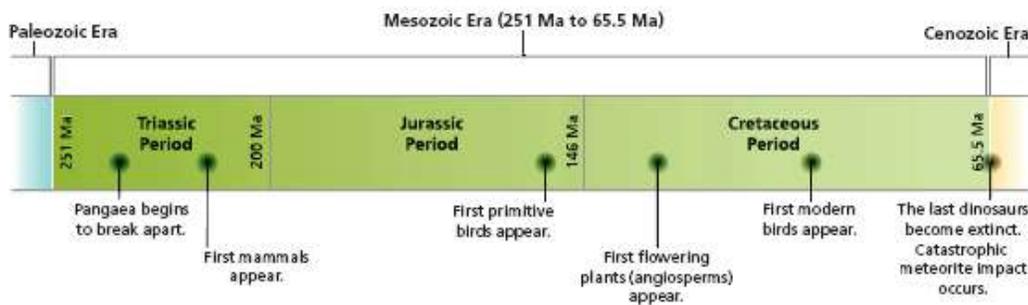
## The Mesozoic Era

mass extinction an episode during which large numbers of species become extinct

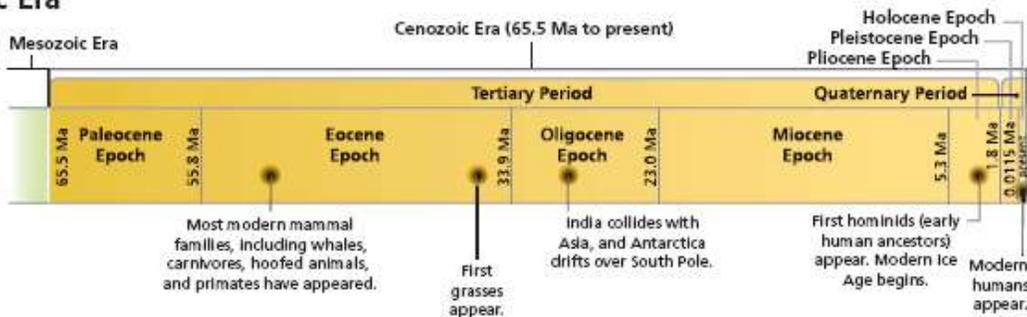
Mesozoic Era the geologic era that lasted from 251 million to 65.5 million years ago; also called the *Age of Reptiles*.

- Earth's surface changed dramatically during the Mesozoic Era. Pangaea broke into smaller continents, and the climate was warm and humid.
- Lizards, turtles, snakes and dinosaurs flourished during this era.

### The Mesozoic Era



### The Cenozoic Era



## The Triassic Period

- The Mesozoic Era is known as the Age of Reptiles and is divided into three periods: the Triassic, the Jurassic, and the Cretaceous Periods.

- The Triassic period marked the appearance of dinosaurs. Most dinosaurs were about 4 m to 5 m long and moved very quickly.
- Reptiles called ichthyosaurs lived in the oceans. The ammonite, a marine invertebrate, was dominant, and serves as a Mesozoic index fossil.

### The Jurassic Period

- Two major groups of dinosaurs evolved during the Jurassic Period: the saurischians, or “lizard-hipped” dinosaurs, and the ornithischians, or “bird-hipped” dinosaurs.
- Brontosaurus, now called Apatosaurus were saurischians. Stegosaurus and Pterosaurs were ornithischians.

### Reading Check

Name two fossils that were discovered in the fossil record of the Jurassic Period.

*Your answer could include any two of the following:*

*Archaeopteryx, pterosaurs, Apatosaurus, and Stegosaurus.*

### The Mesozoic Era, *continued*

#### The Cretaceous Period

- Among the common Cretaceous dinosaurs were the Tyrannosaurus Rex, the ankylosaurs, the ceratopsians, and the hadrosaurs.
- The earliest flowering plants, or angiosperms, appeared during this period. The most common of these plants were magnolias and willows.
- Later, trees such as maples, oaks, and walnuts became abundant.

### The Cretaceous-Tertiary Mass Extinction

- **The Cretaceous Period ended in another mass extinction. No dinosaur fossils have been found in rocks that formed after the Cretaceous Period.**
- **Many scientists accept the impact hypothesis as the explanation for the extinction of the dinosaurs. This hypothesis is that about 65 million years ago, a giant meteorite crashed into Earth.**
- **The impact of the collision raised enough dust to block the sun's rays for many years, resulting in a colder climate that caused plant life to die and many animal species to become extinct.**

### **The Cenozoic Era**

**Cenozoic Era - the current geologic era, which began 65.5 million years ago; also called the Age of Mammals**

- **During the Cenozoic Era, dramatic changes in climate have occurred. As temperatures decreased during the ice ages, new species that were adapted to life in cooler climates appeared.**
- **Mammals became the dominant life-form and underwent many changes.**
- **The Cenozoic Era is divided into two periods: the Tertiary Period and the Quaternary Period.**

### **Quaternary and Tertiary Periods**

- **The Tertiary Period includes the time before the last ice age, and is divided into five epochs: The Paleocene, Eocene, Oligocene, Miocene, and Pliocene Epochs.**
- **The Quaternary Period began with the last ice age and includes the present.**
- **The Quaternary is divided into two epochs: The Pleistocene and Holocene Epochs.**

### **The Paleocene and Eocene Epochs**

- The fossil record indicates that during the Paleocene Epoch many new mammals, such as small rodents, evolved.
- Other mammals, including the earliest known ancestor of the horse, first whales, flying squirrels, and bats, evolved during this time.
- Worldwide, temperatures dropped by about 4°C at the end of the Eocene Epoch.

### The Oligocene and Miocene Epochs

- During these epochs, the worldwide climate became significantly cooler and drier. The modern Antarctic icecap began to form. The Mediterranean Sea dried up and refilled several times.
- This climate change caused many early mammals to become extinct. However large species of deer, pigs, horses, camels, cats, and dogs flourished. Also, the climate change favored grasses, cone-bearing, and hardwood trees.

### The Pliocene Epoch

- During the Pliocene Epoch, animals such as bears, dogs, and cats, evolved into modern forms. Herbivores, such as the giant ground sloth, flourished.
- Dramatic climatic changes occurred, and the continental ice sheets began to spread. The Bering land bridge and the Central American land bridge formed, allowing various species to migrate between the continents.

### Reading Check

**Why did sea level fall in the Pliocene Epoch?**

***During the ice ages, water from the ocean was frozen as ice, so the amount of liquid water in the seas decreased and sea level fell.***

### The Pleistocene Epoch

- During the Pleistocene Epoch, ice sheets in Europe and North America advanced and retreated several times.
- Some animals had certain features that allowed them to survive the cold climate, such as the thick fur that covered woolly mammoths.
- Other species survived by moving to warmer regions, while some species eventually became extinct.

### The Pleistocene Epoch

- Fossils of the earliest ancestors of modern humans were discovered in Pleistocene sediments.
- Evidence of more-modern human ancestors indicated that early humans may have been hunters.

### The Holocene Epoch

- The Holocene Epoch began as the last glacial period ended. As the ice sheets melted, sea level rose about 140 m, and the coastlines took on their present shapes.
- Modern humans developed agriculture and began to make and use tools made of bronze and iron.

### Fossil Evidence for Gondwanaland



## **Multiple Choice**

1. Dinosaurs first became the dominant life-forms during which geologic period?
    - A. Quaternary Period
    - B. Jurassic Period**
    - C. Triassic Period
    - D. Cretaceous Period
  2. Pangaea broke into separate continents during
    - F. the Paleozoic Era.
    - G. the Mesozoic Era.**
    - H. the Cenozoic Era.
    - I. Precambrian time.
  3. Why are fossils rarely found in Precambrian rock?
    - A. Most Precambrian organisms did not have hard body parts that commonly form fossils.**
    - B. Precambrian rock is buried too deeply for geologists to study it.
    - C. Most Precambrian organisms were too small to leave fossil remains.
    - D. Precambrian rock is made of a material that prevented the formation of fossils.
  4. Which of the following statements describes a principle of natural selection?
    - F. The environment has more than enough resources to support all of the individuals that are born in a given ecosystem.
    - G. Only individuals well-suited to the environment are likely to survive and reproduce.**
    - H. Individuals in a healthy population are identical and have the same traits.
    - I. Most species produce plentiful offspring that will all live until maturity and reproduce.
- Read the passage below. Then, answer questions 8–11.

## The Discovery of a Dinosaur

In 1995, paleontologist Paul Sereno was working in a previously unexplored region of Morocco when his team made an astounding discovery - an enormous dinosaur skull. The skull was nearly 1.6 m long. Given the size of the skull, Sereno concluded that the skeleton of the animal that it came from must have been about 14 m long - about as long as a full-sized school bus. The dinosaur was even larger than the *Tyrannosaurus rex*. The newly discovered dinosaur was thought to be 90 million years old. It most likely chased other dinosaurs by running on large, powerful hind legs, and its bladelike teeth must have meant certain death for its prey.

8. Which of the following is evidence that the dinosaur described in the passage above was most likely a predator?

- A. *It had sharp, bladelike teeth.*
- B. It had a large skeleton and powerful hind legs used for running.
- C. It was found next to the bones of a smaller animal.
- D. It was more than 90 million years old.

9. What types of information do you think that fossilized teeth provide about an organism?

- F. the color of its skin
- G. *the types of food it ate*
- H. the speed at which it ran
- I. the mating habits it had

10. According to the passage, which of the following statements is true?

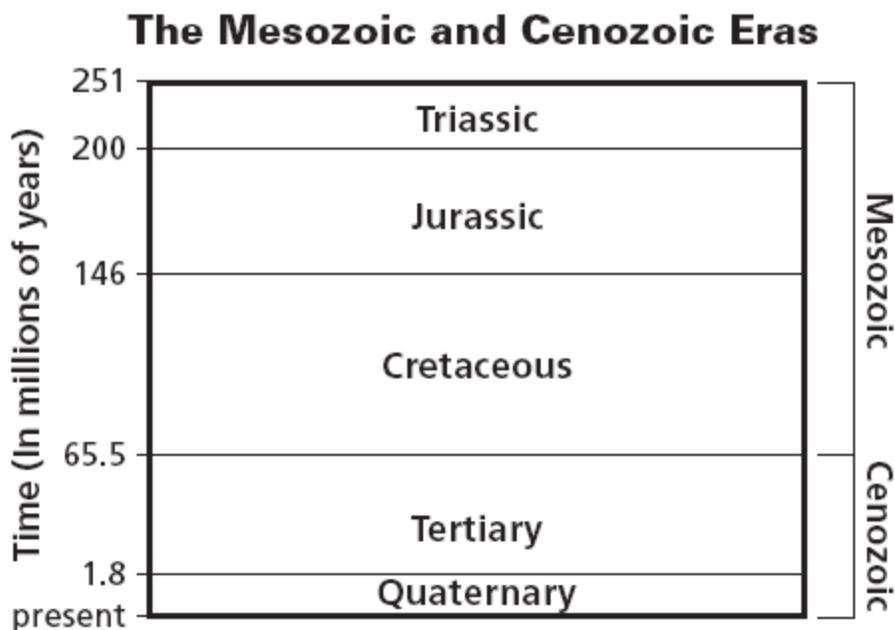
- A. *This dinosaur was most likely a predator.*
- B. This skull belonged to a large *Tyrannosaurus rex*.
- C. This dinosaur had powerful arms.
- D. This dinosaur ate mainly plants and berries.

**11. What are some methods that scientist might have used to determine that the age of the dinosaur skull was 90 million years old?**

**Your answer should include the following points: an understanding that scientists not only can, but usually do, use multiple means of authentication when dating the remains of ancient plants and animals. Scientists could use carbon dating to determine the skull's age; scientists could also use nearby index fossils and stratigraphic layers to further support their carbon dating results.**

### **Interpreting Graphics**

**Use the figure below to answer questions 12 -14. The timeline shows the time divisions of the Mesozoic and Cenozoic eras.**



**12. Human civilization developed during which of the following periods of time?**

- A. Triassic Period**
- B. Jurassic Period**
- C. Tertiary Period**
- D. Quaternary Period**

**13. If Earth formed about 4.6 billion years ago, what percentage of Earth's total history did the Cenozoic period fill?**

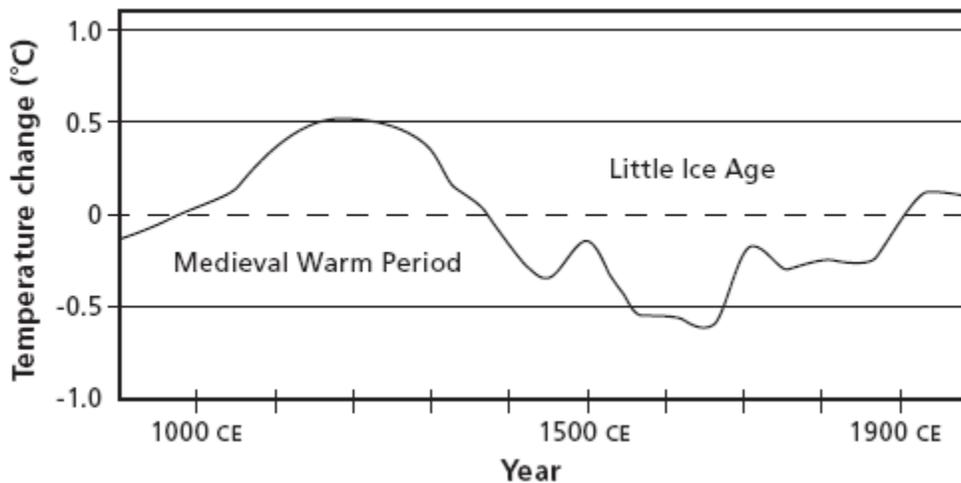
- F. About 1.5 %**
- G. About 10.5%**
- H. About 15%**
- I. About 50%**

**14. Which event coincides with the start of the Cenozoic Era?**

**The mass extinction of the dinosaurs.**

**The graph below shows data on global temperature changes during the last millennium. Use this graph to answer question 15.**

**The Medieval Warm Period and the Little Ice Age**



**15. How do you think the temperature changes during the Little Ice Age of the Middle Ages affected the freezing and thawing of global waters? Explain your answer.**

**During the Little Ice Age, glaciers did not increase in size by very much, but local freezing dates came earlier and thawing dates came later.**