

How Dinosaurs Tell Time in Grand Staircase Escalante National Monument

Student Activity



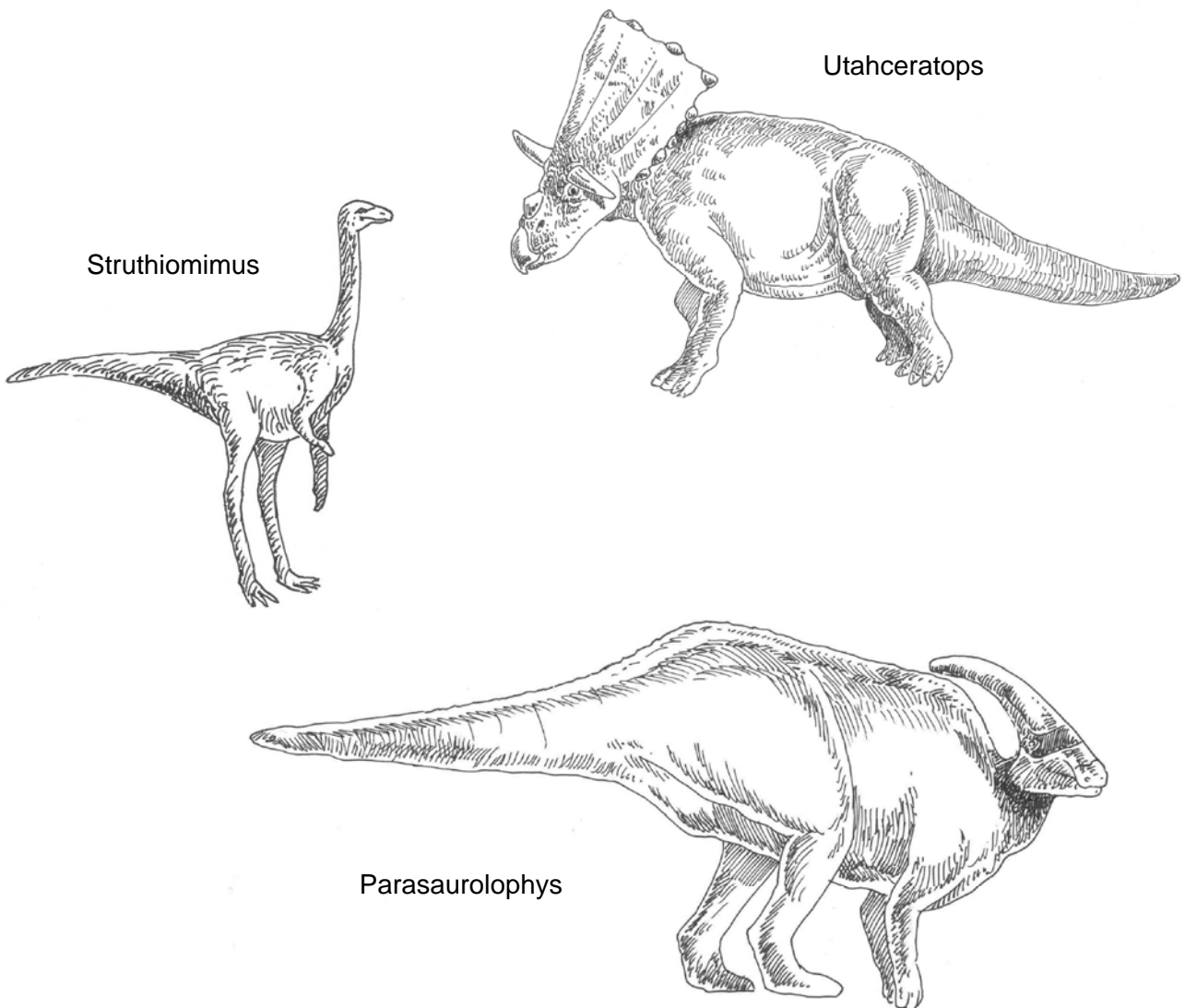
Grand Staircase-Escalante National Monument



How Dinosaurs Tell Time in Grand Staircase-Escalante National Monument

Many of the rock layers in Grand Staircase-Escalante National Monument were formed in the Cretaceous Period. These Cretaceous rocks hold a treasure trove of fossils, including many species of dinosaurs. In fact, in these layers of Cretaceous rocks scientists have found the most complete series of *terrestrial*, late Cretaceous fossils found anywhere on Earth.

Dinosaur discoveries have been made primarily in rock layers 100-75 million years old (mya). Each field season more Cretaceous dinosaurs are discovered and most of these species are new to science.



In this activity you will interpret the geologic history of Grand Staircase-Escalante National Monument by examining the *Geologic Time Line* and dinosaurs that have been excavated in, or near, its boundaries.

Geologic Time Line

Paleontologists and geologists study fossils and rock layers to learn about ancient environments and the organisms that inhabited them. Over the last two centuries a great deal of worldwide research has gone into creating a Geologic Time Line. This has enabled scientists to place dinosaurs into Earth's history.

Earth's Geologic Time Line begins with the formation of the planet about 4.6 billion years ago and continues through present time. The largest subdivisions of geologic time are *Eras*. The three eras most often studied by paleontologists are:

<p>Paleozoic Era "ancient animals"</p>	<p>Began 542 mya Ended 251 mya Lasted 291 million years</p>	<ul style="list-style-type: none"> • Corals, fish, trilobites, mollusks and coal swamps were some of the dominant environment and life forms of this era. • At the end of the Paleozoic Era a mass extinction of 95% of all species occurred.
<p>Mesozoic Era "middle animals"</p>	<p>Began 251 mya Ended about 65 mya Lasted 186 million years</p>	<ul style="list-style-type: none"> • During this time dinosaurs flourished. They differentiated, expanded their range, and diversified into a wide variety of types. They became dominant land animals. • Mammals, birds, and flowering plants began to evolve. • The Mesozoic Era ended in another mass extinction, killing about 75% of all species.
<p>Cenozoic Era "recent animals"</p>	<p>Began 65 mya and continues today</p>	<ul style="list-style-type: none"> • The Cenozoic Era is the age of mammals. • Flowering plants (angiosperms) spread around the world.

Eras are subdivided into *Periods*, and the Mesozoic Era is divided into three Periods. The following table is an overview of dinosaurs by Period with an emphasis on the dinosaurs found in GSENM.

Mesozoic Era	Triassic Period	<p>Began 251 mya (the start of the Mesozoic era)</p> <p>Ended about 200 mya, Lasted 51 million years</p>	<ul style="list-style-type: none"> • In the late Triassic, about 230 mya, dinosaurs began to develop. During this Period there were huge amphibians and reptiles. • GSENM does not have dinosaur fossils in its rock strata from this age, so the early years of dinosaur evolution are not represented in the Monument.
	Jurassic Period	<p>Started about 200 mya</p> <p>Ended about 144 mya, Lasted 62 million years.</p>	<ul style="list-style-type: none"> • In GSENM there is fossil evidence of stegosaurus and huge sauropods from the Jurassic. These are mostly isolated bones and footprints, not complete skeletons.
	Cretaceous Period	<p>Followed the Jurassic's end at 144 mya</p> <p>Continued through the great extinction of 65 mya.</p> <p>Lasted 79 million years</p>	<ul style="list-style-type: none"> • During these 79 million years an amazing diversity of dinosaurs roamed the area that would later become Grand Staircase-Escalante National Monument.

To summarize, dinosaurs first appeared in the late Triassic (about 230 mya), declining in the mass extinction 65 mya. Their reign on Earth lasted about 165 million years.

In the past, scientists have considered the mass extinction at the end of the Cretaceous Period to be the end of dinosaurs. Recent discoveries indicate that birds are direct descendants of dinosaurs. If these new discoveries are upheld by further scientific research, then not all dinosaurs became extinct 65 million years ago.

The following internet links will give you more information about...

Geologic Time

Dinosauria.com

<http://www.dinosauria.com/dml/dmlf.htm>

Northern Arizona University's Global Paleogeographic Views of Earth History

<http://jan.ucc.nau.edu/~rcb7/globaltext2.html>

The Cretaceous Extinction

National Geographic News-August 23, 2005 –

http://news.nationalgeographic.com/news/2005/08/0823_050823_dinolava.html

University of California Berkeley –

<http://www.ucmp.berkeley.edu/diapsids/extinction.html>

Geo Times

http://www.agiweb.org/geotimes/feb05/feature_25years.html

Dinosaurs of GSENM

As of May 2005, there were 937 genera of dinosaurs described worldwide. The rate of discovery, worldwide, is one new dinosaur about every 7 weeks. Grand Staircase-Escalante National Monument has contributed to this rapid rise of dinosaur species.

The following table lists all of the dinosaurs found in GSENM by Order and Genus. Notice that two are so new they haven't been described yet!

Dinosaurs of Grand Staircase-Escalante National Monument

ORDER SAURISCIA		Genus
Theropods	maniraptorans	Hagryphus
		Troodon
	dromaeosaurids	Dromaeosaurus
		Saurornitholestes
	ornithomimids	Struthiomimus
	tyrannosaurids	Daspletosaurus
		tyrannosaurid not yet described
segnosaurs	Nothronychus	
"carnosaurs"	Dilophosaurus	
Sauropods	brachiosaurids	Brachiosaurus
	camarasaurids	Camarasaurus
ORDER ORNITHISCHIA		
Thyreophorans	nodosaurids	Edmontonia
	ankylosaurids	Euoplocephalus
Ornithopods	hypsilophodonts	Thescelosaurus
	hadrosaurs	Brachylophosaurus
		Gryposaurus
		Parasaurolophus
Marginocephalians	ceratopsians	Utahceratops gettyi
		Zuniceratops
	centrosaur	centrosaur not yet described
	pachycephalosaurs	Stegoceras

Step 1. Research and Record

Okay, now it's time for a little research. The following table is basically a copy of the previous one with some minor adaptations. Dinosaurs are alphabetized, those that were "not yet described" have been deleted and two dinosaurs, for which you will not be able to find information online, have been completed for you. Use the internet to collect the following data about dinosaurs of GSENM. Record the data you collect online in the **Data Table for GSENM Dinosaurs** on page 6.

- I. Geologic Period
- II. Time span – millions of years ago (mya)
- III. Type of diet – *Carnivore*, *Omnivore*, *Herbivore*
- IV. Size

The following sites are good references:

Natural History Museum of London

<http://www.nhm.ac.uk/>

- (1) Click on "Kids only" (top bar)
- (2) Click on "What dinosaur are you?"
- (3) Click on "Dino Directory" (right hand column)

Jurassic Park Institute

<http://www.jpoinstitute.com/dinopedia>



Step 2. Organize your data

- I. Using the table on page 7, sort the dinosaurs by geologic periods (Early/Late Jurassic, Early/Late Cretaceous)
- II. Within the geologic periods sort the dinosaurs by time span.
- III. Within each time span, sort the dinosaurs into herbivores or carnivores; omnivores can be lumped in with the carnivores.
- IV. Sort the herbivores and carnivores by size, smallest to largest.

Question 1

Data Table for GSENM Dinosaurs

Genus	Geologic Period	Time Span (mya)	Diet	Size
Brachiosaurus				
Brachylophosaurus				
Camarasaurus				
Daspletosaurus				
Dilophosaurus				
Dromaeosaurus				
Edmontonia				
Euoplocephalus				
Gryposaurus				
Hagryphus	Upper Cretaceous	75 mya	Omnivorous	3 M long
Nothronychus				
Parasaurolophus				
Sauromitholestes				
Stegoceras				
Struthiomimus				
Thescelosaurus				
Troodon				
Utahceratops	Upper Cretaceous	75 mya	Herbivorous	7 M long
Zuniceratops				

Question 2

Geologic Period	Time Span	Diet	Size	Genus
Early Jurassic	190 mya			
Late Jurassic	155 – 140 mya			
	150 – 140 mya			
Early Cretaceous	90 mya			
	84 mya			
	76 mya			
Late Cretaceous	89 – 88 mya			
	76 – 74 mya	Herbivore		
	76 – 70 mya	Carnivore		
	76 – 70 mya			
	76 – 67 mya			
	75 mya			
74 - 65				

Step 3. Assessment

Analyze your data to answer the following questions

Question 3

Which Period had the greatest diversity of dinosaurs in GSENM? (Identify the period by Early, Middle, or Late). How many, and what are their names?

Question 4

From your data, what are the ratios of carnivores to herbivores in the following periods:

a) Early Jurassic _____

b) Late Jurassic _____

c) Early Cretaceous _____

d) Late Cretaceous _____

Question 5

During which Period(s) do you think there was an abundance of vegetation? Why?

Question 6

Can you determine which dinosaur was the top predator (carnivore) in the Late Cretaceous? Explain how you reached your conclusion.

Question 7

If you were a scientist, what would your next step be in researching the ancient environment and inhabitants of GSENM?

Vocabulary:

Carnivore

An animal that eats other animals

Era

A division of geologic time composed of Periods

Geologic Time Line

Time line developed by geologists and other scientists to describe the timing and relationships between events that have occurred during the history of the Earth

Herbivore

An animal that feeds on plants

Omnivore

An animal that feeds on both plants and animals

Period

A division of a geologic Era

Terrestrial

Land based, as opposed to aquatic or atmospheric