

# Educator Guide



## BACKGROUND INFORMATION

Welcome to the world of the late Cretaceous Period, filled with huge carnivorous marine reptiles with double-hinged jaws and teeth in the middle of their palates. Come see gigantic flesh-eating fish big enough to swallow an adult human being whole, flying reptiles with 3-foot skulls, and the biggest sea turtles to have ever lived.

Many bizarre and gigantic forms of life populated the prehistoric waters of the late Cretaceous Period. The Midwest was actually underwater at one time. Kansas has only been above sea level for the last 65 million years. Before that, it was home to a variety of sea creatures, including a 45-foot long mosasaur, a sea turtle the size of a small truck, a giant carnivorous fish, and a long-necked plesiosaur. Although these prehistoric marine animals lived during the time of *Tyrannosaurus* and *Triceratops*, they are not dinosaurs. Dinosaurs lived on land and did not have wings for flying or fins for swimming.

Many Cretaceous marine fossils have been found in Western Kansas. These fossils have been found in thousands of feet of marine sediments made up of shale, chalk, limestone, and sandstone.

## Common Questions

- **When was the Cretaceous period?**  
The Cretaceous Period extended from 144 to 65 million years ago.
- **What is a mosasaur?**  
A mosasaur is a large marine lizard with a long body and paddle-like limbs. Mosasaurs are not dinosaurs. The chief feature that distinguishes them from dinosaurs is the great flexibility and power of their jaws. Unlike most monstrous reptiles of the past, they still have living relatives, the giant monitor lizards such as the Komodo Dragons.
- **Where can mosasaurs be found?**  
Mosasaurs have been found on all of the continents and New Zealand, but the best place to collect them is in the Niobrara Chalk in Kansas, where more mosasaurs have been found than in the rest of the world put together.
- **Was Kansas once under water?**  
The region of North America's Midwest, from the Gulf of Mexico to the Arctic Circle, was once under the ocean. During most of the Mesozoic Era, Kansas was under the seaway that ran from the north to the south of North America.
- **What caused the extinction of dinosaurs and sea monsters?**  
Many scientists believe that an asteroid impact was the main cause for the mass extinction that marked the end of the Cretaceous Period. This impact resulted in dust and debris, lower temperatures, global fires, tidal waves, and severe storms. Those living things that could not adapt to their new environments died.

## Savage Ancient Seas Specimen List



**Archelon** (ARK eh lon)  
*Archelon ischyros*  
17 feet wide  
Giant Sea Turtle (largest ever found)

**Clidastes** (Klie DAS teez)  
*Clidastes propython*  
11 feet long  
Marine Lizard (smallest mosasaur)

**Elasmosaurus** (Ee LAS moh SOAR us)  
*Elasmosaurus platyurus*  
42 feet long  
Marine Reptile (long necked plesiosaur)

**Hesperornis** (Hes per ORN is)  
*Hesperornis*  
3 feet long  
Bird (largest of flightless diving birds)

**Megalodon** (Meg a lo DON)  
*Carcharocles megalodon*  
8.5 foot high jaw  
Fish (largest species of shark)

**Pachyrhizodus** (PAK ee rize OH dus)  
*Pachyrhizodus caninus*  
6 feet long  
Fish (ray-finned)

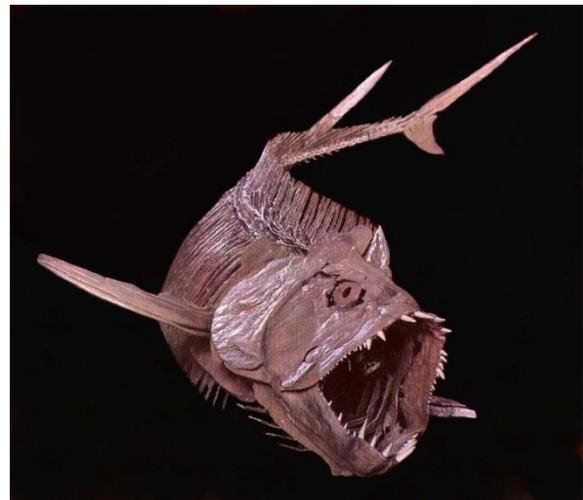
**Pteranodon** (The RAN uh don)  
*Pteranodon sternbergi*  
11 foot wingspan  
Flying Reptile (largest flying creature)

**Platecarpus** (PLAT ee KAR pus)  
*Platecarpus ictericus*  
15 feet long  
Marine Lizard (most abundant mosasaur)

**Toxochelys** (TOKS eukee leez)  
*Toxochelys*  
9.5 inches long (juvenile)  
Sea Turtle (relative of modern sea turtles)

**Tylosaurus** (TIE low SOAR us)  
*Tylosaurus proriger*  
45 feet long  
Marine Lizard (largest mosasaur)

**Xiphactinus** (Zie FAK tin us)  
*Xiphactinus audax*  
12.5 feet long  
Fish (Ray-finned fish)



# **Classroom Activities**

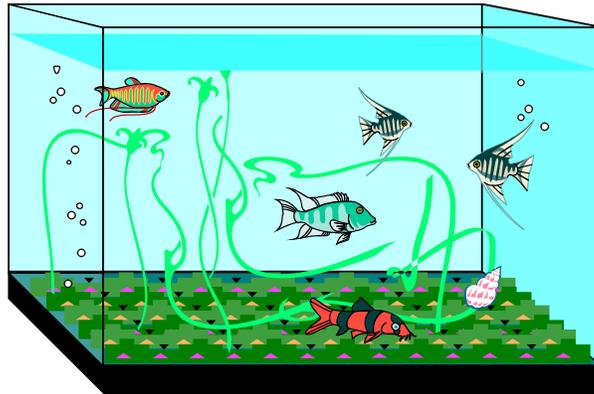
## UNDERWATER DIORAMA

### Materials Needed:

Shoebox	Index cards
String	Modeling clay (optional)
Scissors and glue	Construction paper

### Activity:

Select two or more animals and design an underwater diorama to showcase their habitat. Use a shoebox lined with blue paper and hang construction paper or paper mache animals with string, or use an aquarium actually filled with water and make the creatures out of lightweight modeling clay. Attach descriptive fact cards about habitat and physical features to the back or top of the container.



## PREHISTORIC MOBILES

### Materials Needed:

Wire coat hangers	Construction paper or cardboard
String	Dowel rods

### Activity:

Select five or six animals. Make cardboard, clay, or pipe cleaner models, and create a mobile from a clothes hanger or dowel rods. Write interesting facts directly on the models, or hang companion fact cards with each animal.

## CRETACEOUS COMPOSER

### Materials Needed:

- Background accompaniment music (optional)
- Rhythm instruments
- Props
- Art paper



### Activity:

- Compose a song or rap, describing one of the creatures from the exhibit. Write new lyrics for a familiar tune (Battle Hymn, Under the Sea, or Jingle Bells.) Use drums, sticks, or other rhythm instruments to accompany the performance of the song.
- Create a shape poem or haiku to describe one of the creatures. Use the outline of the animal to structure the poem, or write a haiku with accompanying illustrations and roll the finished paper like a scroll.

## DIARY OF AN EXPLORER

### Materials Needed:

- Paper and pen (parchment paper optional)
- Construction paper



### Activity:

Create a diary of an underwater explorer who time travels to the world of the Cretaceous sea animals. Enter daily logs, with exciting descriptive events that educate the reader about the animals. Use parchment paper to give the diary a worn antique look.

## CREATE A CREATURE

### Materials Needed:

- Greek and Latin Descriptor list (included in guide)
- Pencil and paper
- Drawing paper or modeling clay



### Activity:

Find the meaning of the animal names using the Greek and Latin descriptor list. Create ten new names using the list and write the names on paper. Use two or more descriptors for each. Choose one of the new names and draw or model that animal to fit the name. Write an accompanying paragraph describing the creature, its physical characteristics, behavior, and habitat.

## NEWS FLASH

### Materials:

- Newsprint paper
- Sample newspapers
- Research materials (encyclopedias, internet)



### Activity:

Research several of the animals and write news stories, with front page headlines and editorials. Include artwork or “photos” with descriptive captions. Divide teams of students into editors, weather reporters, gossip columnists, photographers, cartoonists, etc.

## CRETACEOUS CROSSWORD



### Materials Needed:

Paper and pencil  
Ruler  
Research materials (creature vocabulary list)

### Activity:

Use ten of the animals to construct a crossword puzzle. For definitions, use one or two descriptive words that relate to each animal. Fit the puzzle inside of a creature outline.



## MYSTERIOUS ENDINGS

### Materials:

Paper and pencil



### Activity:

Research current theories about the extinction of dinosaurs and sea creatures. Rewrite the story of how they might have met their demise. Come up with a new theory explaining what happened during their final years.

## HOW BIG WERE THEY?

### Materials Needed:

Graph paper  
Ruler  
Calculator



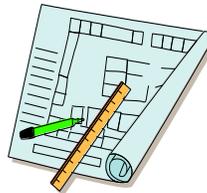
### Activity:

Design a collage of creatures comparing their sizes to items in today's world. Next to each animal drawing, place a magazine cutout or drawing to show relative sizes. Use large objects such as houses and trucks; determine their average sizes, and draw the creature to scale. Label the actual sizes of the objects as well as the animals. Be sure to indicate the scale ratio used.

## CREATURE SCALE

### Materials Needed:

Graph paper  
Calculator  
Ruler



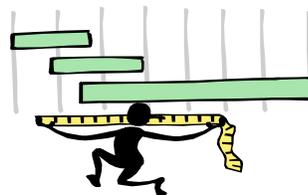
### Activity:

Using graph paper, draw several creatures to scale, with each square representing specific meters or feet. Label each animal with its name and its actual size. Include the scale ratio used.

## TIMELINE SCRAMBLE

### Materials Needed:

- Meter stick
- Index cards
- Calculator
- Roll of adding machine paper (or long strips of paper taped together)
- “Exercise in Deep Time Conception” (included in guide)



### Activity:

Write geological events, creature names, or geological descriptions on several cards. Make one set of cards per team of students. Using adding machine paper, students mark off time in thousands of years by determining a proportional measurement of actual years to centimeters. Students then glue the cards on the appropriate places on the timeline.

## MINI DIG SITES

### Materials Needed:

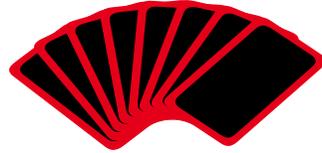
- Plastic bins or boxes
- Sand
- Hand shovels and paint brushes
- Small objects to bury in the sand
- String



### Activity:

Use plastic bins or boxes to create a mini dig site for each team of students. In each box, layer sand with small artifacts, bones, or other items. Students can section off the box with string to create quadrants in which to search for clues to what might have lived in that area. Students then write a short description of the person, culture, or creature they discovered by relating the artifacts to particular activities that might have occurred.

## TRADING CARDS



### Materials Needed:

- Index cards (unruled)
- Markers
- Creature images downloaded from web sites (optional)

### Activity:

Design a set of sea creature trading cards. On one side of each card, draw the animal (or paste the downloaded image) and on the other side, list facts about the animal, with the animal's scientific name. Use the cards to play a memory matching game, as flash cards, or have students design an original game.

## CLASSROOM MUSEUM

### Materials:

- Construction paper, markers and variety of art supplies
- Graph paper
- Meter sticks

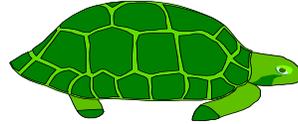
### Activity:

Design a classroom museum to display prehistoric underwater animals. Make a floor plan, using graph paper, to determine the placement of the specimens. Have teams of students be responsible for particular models, making sure that they are constructed in correct proportions. Include signage to educate about each animal. Hang the models from the ceiling at various heights. Compose brochures to explain the exhibit, and invite parents and other classes to visit.

## WHO SURVIVED?

### Materials Needed:

Research resources  
Poster board, markers



### Activity:

Research the animals that escaped extinction and survive today. What animals living today were around during the Cretaceous Period? What animals have close relatives from the Cretaceous Period? Design a “family tree” for one of these animals, showing how it might have evolved into the animal we are familiar with today.

Suggestions: coelacanth, sea turtle, chambered nautilus

## CREATURE FEATURES

### Materials Needed:

Research resources

### Activity:

Research various unique physical characteristics, adaptations, or behaviors that prehistoric marine animals possessed. How did these features assist them?

Draw pictures of the animals, illustrating the feature in action.

Suggestions: paddles, locking vertebrae, teeth in the palate, thick eardrums, flattened wrist and ankle bones, flexible lower jaws, swallowing fish head first

# GREEK AND LATIN DESCRIPTORS

## Animal Parts

arm	brachio-
beak	rostr- rhyncho-
claw	ungui- chelo- onycho-
finger	datyl- stenotes
foot	pedi- podo- elmi pos pes
head	capit- cephalo- top
horned	cornut- cera-
jaw	gnathus
nose	rhino-
skin	derm
tail	caud- cerco- luro
toes	phalangia
tooth	denti- odonto- don den
winged	ptero

## Textures

bare	nudi- gymno-
bearded	criniti- pogono-
hairy	hirsut- lasio- trichodo-
lumpy	nodo
plated	elasmo
ridged	lopho
rough	asper- trachy-
sharp	angusti
spiked	canthus echino
spiny	spini- acantho- echino-
wooly	lana
wrinkled	corrugat- rugos-

## Numbers

one	mono- uni-
two	bi- duo- di-
three	tri- tria-
four	quadri- tetra-
five	penta-
seven	septem- hepta-
ten	decim- deca-
many	pola- poly-
single	mono-

## Sizes

dwarf	pumili- nano
gigantic	ingenti- colosso-
heavy	baro-
huge	mega-
large	grandi- macro- mega-
short	brevi- brachy
tall	proceri- alti- aepey-

## Shapes

curved	Cyrto-; gampso-
egg-shaped	ovato-
flat	Plani-; platy-; placo-; plateo-
hollow	cavi- coelo
narrow	steneo
round	Circuli-; cyclo-; gyro-
slender	lepto

## Colors

black	atri- nigri- melano-
blue	cerule- cyano-
green	viridi- chloro-
white	albi- leuco-
yellow	flav- xantho-

## Other

alarming	tarbo
beast	thero
bird	ornitho-
deceptive	apato-
fast	velox veloci
fearsome	phobo
good mother	maia
iguana	iguano
king	rex
lizard	saurus
mimic	mimus

mixed	hetero-
no, not	a ar and
ostrich	stuthio
pointed	mucro
pretty	compso
reptile	saurus
robber	lestes
roofed	stego
running	dromaeo
shaped	morpho
sloping	preno

slow	segno
speedy	velox veloci
strange	allo
terrible	deino
thick	pachy
thief	raptor
top	acro-
thunder	bronto
twin	stereo
tyrant	tyranno-
wounding	drypto

## AN EXERCISE IN DEEP TIME CONCEPTION

We *Homo sapiens* sometimes have difficulty visualizing the span of months, let alone the span of millions of years. Imagine you are taking a walk through time. Each step takes you back 1000 years. The following table shows you how far you would walk to witness certain important events in the history of the Earth. (Ma means mega-annums, or the number of million year periods from present to the time under consideration):

DISTANCE	TIME	EVENT
2 steps	2000 years	Time of Christ
10 steps	10,000 years	Final days of mammoths, mastodons, saber-toothed cats; at close of last great Pleistocene glaciation
30 miles	65 Ma	End of Mesozoic; Age of Reptiles
100 miles	225 Ma	Appearance of first dinosaurs and mammals
120 miles	245 Ma	Great Permian extinction that wiped out most of life on earth, including total eradication of trilobites
140 miles	300 Ma	Appearance of first reptiles
170 miles	360 Ma	Appearance of first insects
200 miles	435 Ma	Appearance of first land plants
205 miles	440 Ma	Appearance of first vertebrates
270 miles	579 Ma	Appearance of first animals with hard shells
280 miles	600 Ma	Appearance of first multicellular organisms
650 miles	1400 Ma	Appearance of first nucleated cells
1800 miles	3900 Ma	Formation of oldest rock known today
2100 miles	4600 Ma	Formation of Earth

