

CSI: CRETACEOUS SEAS INVESTIGATION

Every fossil has a story to tell. In this lesson, students learn how paleontologists study fossils from prehistoric times to gain insights into animals and their interactions. In Activity 1, students participate in a class activity to learn how fossils provide important clues to past life. In Activity 2, students examine a site map based on an actual discovery to gain a rare glimpse into the final moments of two extinct sea creatures. In the Closing Activity, students examine a fossil discovery in order to make their own site map.

Vocabulary (see Glossary)

cartilage	paleontologists
conical	paleontology
evidence	predator
fossil	prehistoric
inference	prey
intact	remains
late Cretaceous	sedimentary rock
mosasaur	vertebrae

Try This First!

Ask students, “What is a fossil?” Explain that the study of fossils and the fossil record is called “paleontology” and that scientists who specialize in this research are called “paleontologists.” Next, distribute and discuss “A Fossil Forms,” a student handout.

Guiding Question:
How do scientists analyze fossil evidence to reconstruct life in prehistoric times?

Activity	Objectives	Instructional Strategy	Materials
ACTIVITY 1 Cretaceous Clues 25 min.	Students will: <ul style="list-style-type: none"> - Learn how fossils provide evidence about a prehistoric plant or animal; and - Learn how evidence found in fossils is used to understand prehistoric life. 	<ul style="list-style-type: none"> - Large-group Instruction 	
ACTIVITY 2 “Impossible Fossil” Site Map 25 min.	Students will: <ul style="list-style-type: none"> - Identify information from a site map; - See how paleontologists record information; and - Learn how fossil evidence is used to understand prehistoric life. 	<ul style="list-style-type: none"> - Discussions - Visual Instruction - Large-group Instruction 	<ul style="list-style-type: none"> - “‘Impossible Fossil’ Site Map”
CLOSING ACTIVITY Create a Site Map 45 min.	Students will: <ul style="list-style-type: none"> - Examine an illustration and scientific notes; and - Create a site map to record a fossil discovery. 	<ul style="list-style-type: none"> - Individual Instruction - Large-group Instruction 	<ul style="list-style-type: none"> - “Create a Site Map: Parts 1 & 2” - Ruler

Activity 1

Cretaceous Clues

Students learn how fossils provide important clues to past life.



Directions:

1. Explain. Tell students that fossil evidence provides clues about past life. By studying an individual fossil, for example, a paleontologist can infer the age, size, brain capacity, locomotion, feeding preferences, and other information about an animal that lived millions of years ago.

2. Class activity. Write “Fossil Evidence” on the board. Tell students that fossils provide evidence about an animal’s physical appearance, behaviors, and interactions with other animals. Create a chart on the board with two columns labeled “Fossil Evidence” and “Clues to ...?” Write the first evidence as “serrated teeth.” Prompt students to make inferences about this evidence, i.e., *the animal may eat meat*. Ask students to explain their reasons for this, i.e., *sharp teeth are needed to tear flesh*. Continue with the other “Fossil Evidence” listed in the chart below.

Possible answers:

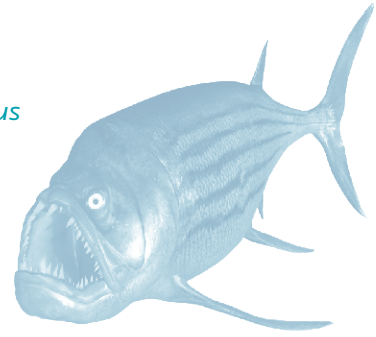
Fossil Evidence

- sharp teeth*
- extremely long neck*
- bones not fully developed*
- marks on bones*

Clues to...?

- may eat meat*
- reach for food quickly or hard to reach places*
- possible juvenile*
- signs that other animals bit, chewed, or scavenged*

Xiphactinus



3. Building on learning. Now have students consider what clues two or more fossils together might provide. Sometimes this fossil evidence provides clues about the interactions between prehistoric animals. Have students brainstorm different ways in which animals behave and interact with one another.

Possible answers: *parasite/host, predator/prey, family group, communal group, reproduction, or feeding.*

Then have students try to come up with some examples of fossil evidence to make inferences about possible animal interactions.

Possible answers:

Fossil Evidence

two different animal bones together

clam shells inside rib cage

Clues to...?

possible interactions – parasite/host, predator/prey, family group, communal group, reproduction, or feeding

animal ate clams

Caproberyx



Activity 2

“Impossible Fossil” Site Map

Students examine a site map based on an actual discovery to gain a rare glimpse into the final moments of two extinct sea creatures.



“Impossible Fossil’ Site Map”

Directions:

- 1. Distribute “Impossible Fossil’ Site Map” to each student.** Tell students that paleontologists make careful field observations, notes, and drawings when they discover and excavate a fossil. This recorded information provides clues for the paleontologist and, in this case, may provide information about the life and death of prehistoric marine reptiles.
- 2. Review.** Ask students to recall the possible clues they found in the evidence discussed in Activity 1. Remind them that physical evidence can provide a record of an animal’s physical appearance, behavior, and interactions with other animals. Review the types of animal interactions.

- 3. Complete the handout and discuss.** Explain that this site map is modeled after the famous “fish in a fish” fossil discovery. Ask students why this is an appropriate name.

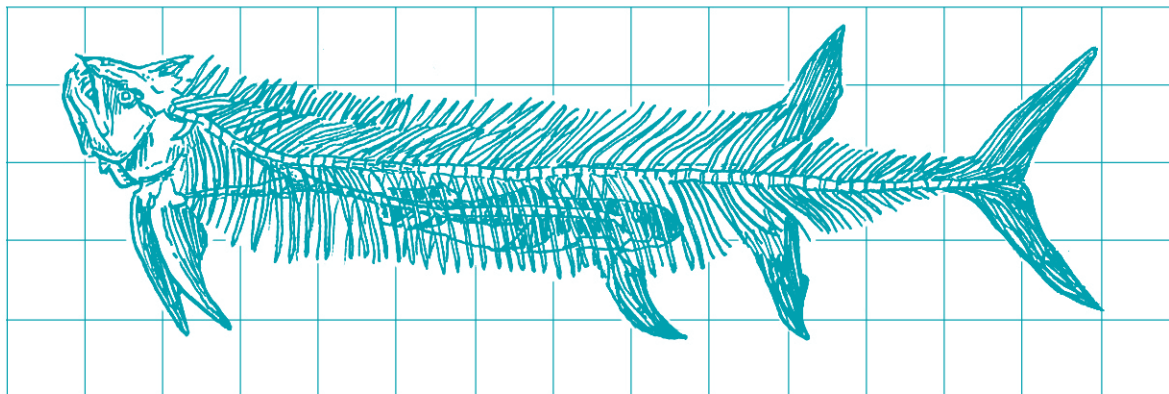
Answer: Because the ribs of the larger fish surround both sides of the smaller fish.

View *Sea Monsters: A Prehistoric Adventure*.

- 4. Discuss.** Ask students to name examples of animal interactions shown in the film. Next, ask students to recall examples of fossil evidence that supported some of these interactions. It may help to prompt students to recall these two examples: shark tooth found in *Dolichorhynchops* limb; *Xiphactinus* skeleton with fossilized fish skeleton found inside its stomach.

Answer Key:

- Smoky Hill Chalk, Gove County, Kansas
- Xiphactinus* and *Gillicus*
- 87-82 mya (during Cretaceous)
- Gillicus* inside ribs of *Xiphactinus*
- Xiphactinus* ate *Gillicus*
- Xiphactinus* ate *Gillicus*
- about 3 feet long



Gillicus inside a *Xiphactinus*

Closing Activity

Create a Site Map

Students examine a fossil discovery in order to make their own site map.



“Create a Site Map: Parts 1 & 2”

Directions:

- 1. Distribute “Create a Site Map: Parts 1 & 2” to each student.** Also, return “‘Impossible Fossil’ Site Map” (Activity 2) to each student.
- 2. Start the activity.** Allow students time to review the vocabulary words, the sketch, and the notes, or review together as a class.
- 3. Review Directions.** Tell students that they will play the role of a paleontologist by creating a site map based on this fossil find. They can use the “‘Impossible Fossil’ Site Map” (Activity 2) as a model.
- 4. Create a site map.** Students can work alone or in groups.
- 5. Student presentations.** Have students present their work to the class. Discuss any interesting ideas or evidence.

STUDENT ASSESSMENT

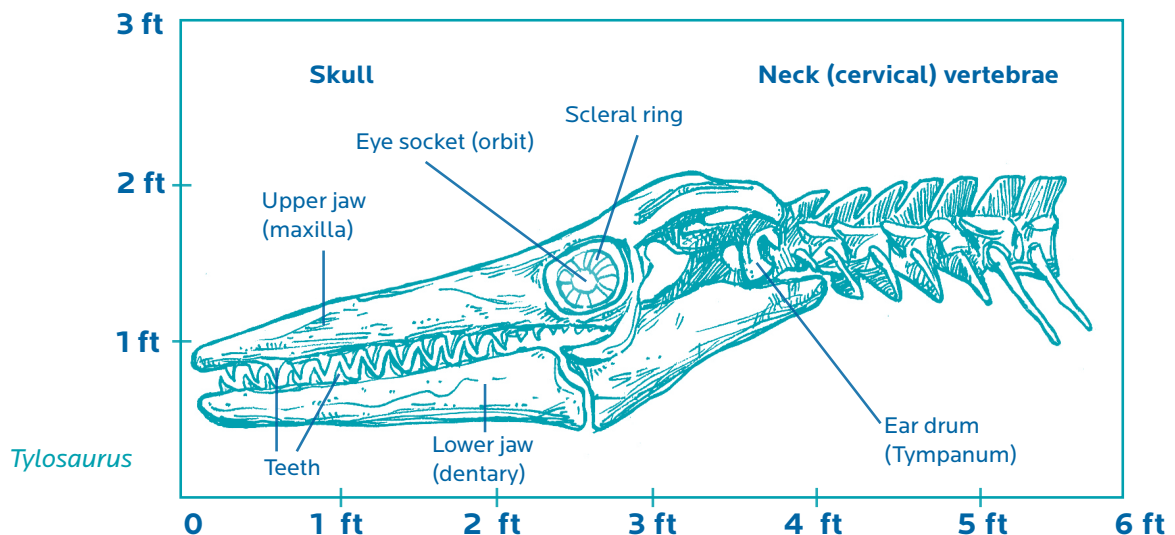
Score student site maps and notes according to the following criteria. Students should:

- Include a scale for the site map. (Note: one square equals one foot)
- Draw the *Tylosaurus* to scale. (Note: the skull is four feet; the seven vertebrae are one foot, eight inches)
- Include at least four observations based on the field notes.

BACKGROUND INFORMATION

How do fossils form?

Only a small percentage of all living plants and animals become fossils. Most are either scavenged or decay before they can be buried and, even then, there is no guarantee that they will be preserved. Specific conditions are required for fossils to form. Plants and animals that die and are quickly buried by mud, sand, volcanic ash, or other sediments are most likely to become fossilized. Once the plant or animal is buried and the sediment has hardened, other factors—including oxygen, sunlight, microorganisms, permineralization and other geologic forces—play an important role. Even with millions of years to form, a fossil is the result of a rare and unique process, and it must be found and analyzed in order to become part of the fossil record. The study of fossils and the fossil record is called paleontology.



A FOSSIL FORMS

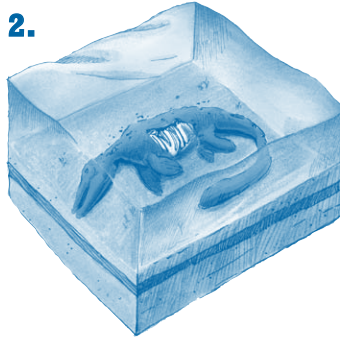
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1.



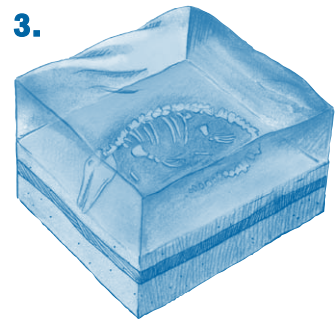
A *Tylosaurus* dies and sinks to the seabed.

2.



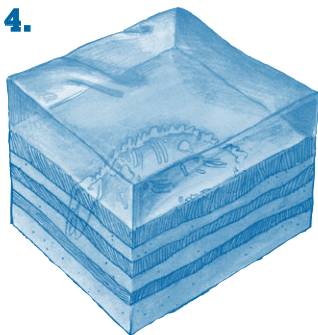
Animals and bacteria remove its flesh.

3.



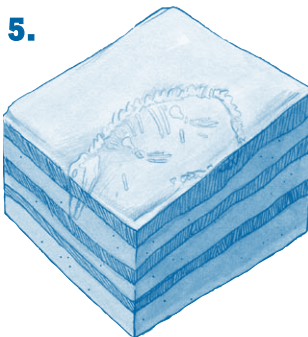
Over time, many layers of sediment bury the remains.

4.



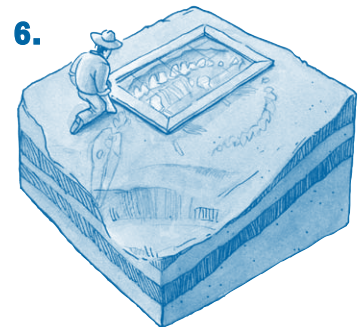
Slowly, the sediments turn into rock and preserve the remains as a fossil.

5.



Millions of years pass. Earth's plates shift and the ocean floor is uplifted. Waters retreat and seabeds become dry land.

6.



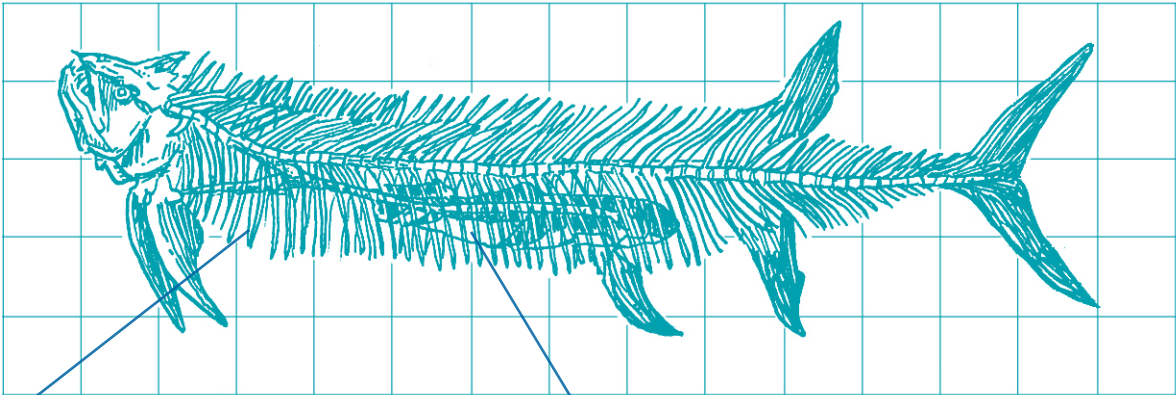
More time passes. Natural forces like wind and water erode layers of sedimentary rock, exposing the fossil.

“IMPOSSIBLE FOSSIL” SITE MAP

Use the site map below to answer the following questions. Write your answers on a separate piece of paper.


1. Where was the discovery made?
2. What is preserved?
3. When did these animals live?
4. What evidence shows a possible animal interaction?
5. What type of animal interaction is suggested by the physical evidence?
6. What do you think might have happened the day these animals died?
7. This fish ate another fish almost half its length. If you were to scale this to the meal of a six-foot-tall person, how long of a sandwich would the person have to eat?

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Scale 1 square = 1 ft²

Observation: *Ribs of large fish around smaller fish*



Observation: *No evidence of acid etching on bones of small fish. Therefore, large fish must have died shortly after ingesting small fish. (No time for stomach acids to dissolve bones.)*

Specimen: *Large fish - Xiphactinus
Small fish - Gillicus*

Collected by: *G.F. Sternberg
Fort Hays State University*

Date of find: *1952*

Age: *87-82 mya (during Cretaceous)*

Location: *Smoky Hill Chalk, Gove County, Kansas*

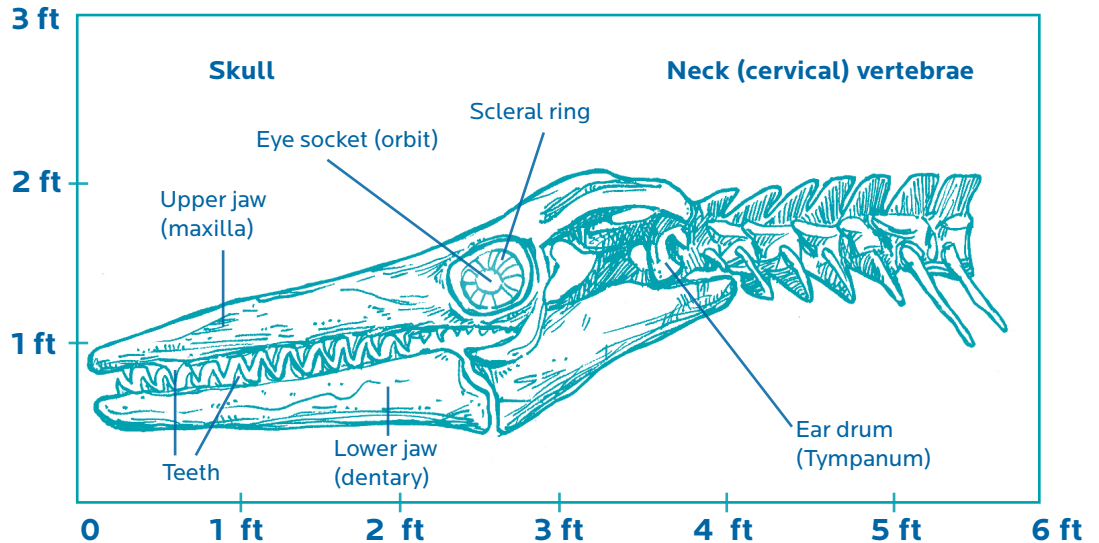
CREATE A SITE MAP: PART 1

Review the words in the Word Bank, the sketch, and the notes below.

Use this information to complete a site map on “Create a Site Map: Part 2.”

Word Bank

cartilage
conical
intact
late Cretaceous
mosasaur
Tylosaurus proriger
vertebrae



This sketch and notes are based on a large fossil found in 1996, in Gove County, Kansas. Based on the location of the find in the sedimentary layers, scientist Mike Everhart estimates the fossil is 85 million years old, dating to the time of the **late Cretaceous**.

Found a four-foot skull and seven vertebrae (one foot, eight inches) of a very large (30 foot) mosasaur in Horsethief Canyon in the Smoky Hill Chalk, Gove County, Kansas. Identified the specimen as a Tylosaurus proriger. Length of skull is a key identifying factor since no other mosasaur of this time was as large.

The left eye socket is intact. This is the first time this feature has been observed in a Tylosaurus.

There seems to be some cartilage where the ear drum would have been.

Although one tooth is missing in the upper jaw, all other teeth are present in the upper and lower jaw. There are 15 teeth in each upper jaw and 13 in each lower jaw. The teeth are conical in shape. The largest are about two inches high with a base that is about 1.5 inches across.

Student Name: _____

Student Handout

CREATE A SITE MAP: PART 2

Create a site map based on the information in Part 1.

1. **Make a grid over the illustration and label.** Use a ruler to draw a 6 X 3 grid over the illustration in Part 1.
2. **Label the site map.** In the grid below, label the y-axis (0 to 3 ft) and the x-axis (0 to 6 ft).
3. **Label scale.** Label the scale on your site map. Hint: If six squares across equals six feet, how much does one square equal?
4. **Copy the illustration.** Use the grid lines to copy the illustration in Part 1 to the grid below.
5. **Add notes and observations.** Use the notes in Part 1 to complete the site map.

Scale: 1 Square = _____

Specimen: _____

Collected by: _____

Date of find: _____

Age: _____

Location: _____

Observations: _____
