

Fossils Tell of Long Ago

Description

Many young children are fascinated by dinosaurs and other prehistoric life. In this lesson, students learn that fossils are the key to learning about these once-living organisms, and that fossils not only tell us about prehistoric life but also give us clues about the Earth's environment back then. Students also discover that only a small percentage of the remains of living things actually become fossilized.

Suggested Grade Levels: 3–5

LESSON OBJECTIVES *Connecting to the Framework*

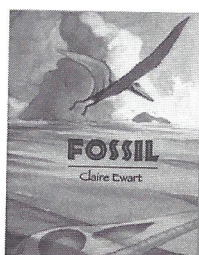
LIFE SCIENCES

CORE IDEA LS4: BIOLOGICAL EVOLUTION: UNITY AND DIVERSITY

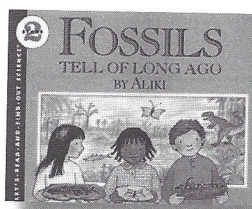
LS4.A: EVIDENCE OF COMMON ANCESTRY AND DIVERSITY

By the end of grade 5: Fossils provide evidence about the types of organisms (both visible and microscopic) that lived long ago and also about the nature of their environments. Fossils can be compared with one another and to living organisms according to their similarities and differences.

Featured Picture Books



TITLE: *Fossil*
AUTHOR: Claire Ewart
ILLUSTRATOR: Claire Ewart
PUBLISHER: Walker Books for Young Readers
YEAR: 2004
GENRE: Narrative Information
SUMMARY: A girl finds a fossil buried in the sand, which takes her imagination back in time to the life of a prehistoric pterosaur, Ornithocheirus. Watercolor illustrations and poetic text give readers an idea of how this ancient creature may have lived, died, and became fossilized over time.



TITLE: *Fossils Tell of Long Ago*
AUTHOR: Aliki
ILLUSTRATOR: Aliki
PUBLISHER: HarperCollins
YEAR: 1990
GENRE: Narrative Information
SUMMARY: Beginning with a description of how a prehistoric fish becomes fossilized, this book explains the process of fossilization and how scientists today learn about past life based on the fossils they find buried on Earth today.

Time Needed

This lesson will take several class periods. Suggested scheduling is as follows:

- Day 1: Engage** with Draw a Dinosaur and *Fossil* Read-Aloud
- Day 2: Explore** with Observing Real Fossils and card sequencing and **Explain** with *Fossils Tell of Long Ago* Read-Aloud
- Day 3: Elaborate** with The Fossil Game
- Day 4: Evaluate** with *Fossil* Rereading and I Found a Fossil Writing Activity

Materials

For Draw a Dinosaur (per student)

- Blank paper or scrap paper

For Observing Real Fossils (per class)

- Animal fossils or reproductions of animal fossils

For Card Sequencing (per group of two to three students)

- Precut fossil formation cards in plastic bags

For the Fossil Game

Per class

- Die
- The Fossil Game Data Table (for teacher use, to be projected in the classroom)
- The Fossil Game Board (for teacher use)

Per student

- Precut Fossil Fortune Teller

For I Found a Fossil (per student)

- Fossil
- Colored pencils

FOR OBSERVING REAL FOSSILS

Fossil kits are available from science supply companies such as

Carolina
(www.carolina.com)

Nasco
(www.enasco.com)

Ward's Natural Science
(www.wardsci.com)

Student Pages

- How to Make a Fossil Fortune Teller
- Fossil Fortune Teller Templates 1, 2, and 3 (divided equally among students)
- I Found a Fossil Journal (Make book by copying cover back-to-back with pp. 1 and 6, and copying pp. 3 and 4 back-to-back with pp. 5 and 2.)
- I Found a Fossil Scoring Rubric

Background

According to *A Framework for K–12 Science Education*, children in grades 3–5 should learn that fossils are used by people today to learn about both the types of living things that lived long ago and the nature of their environments. *Paleontology* refers to the study of fossils and what fossils can tell us about the history of Earth. The American Museum of Natural History website identifies four big ideas of paleontology on the “PaleontOlogy: The Big Dig” section for kids (www.amnh.org/explore/ology/paleontology): (1) fossils tell stories about Earth’s history, (2) fossils can’t tell us everything, (3) fossils are really rare, and (4) the fossil record is like a big jigsaw puzzle, with most of the pieces missing. It is not important that students memorize the names of and specific details about different dinosaurs or prehistoric animals; rather, the focus should be on these “big ideas.”

The term *fossil* refers to physical evidence of former life from prehistoric time. This prehistoric evidence includes fossilized remains of living organisms, impressions and molds of their physical form, and marks or traces created in sediment by their activities. Fossils can be divided into two broad categories: fossilized body parts (bones, teeth, skin, and so on) and fossilized traces (footprints, nests, dung, and so on). There are a variety of ways that living things can become fossilized. This lesson focuses on the process of *permineralization*, in which minerals replace the actual organic remains of the organism.

One objective for this lesson is for students to understand that it is very uncommon for living things to become fossilized. When most organisms die, they decay without a trace after natural processes recycle their soft tissues and even their hard parts such as bone and shell. For a plant or animal to become fossilized, the conditions at the time of death must be just right. If a plant or animal is not buried soon after death, fossilization often becomes impossible because of scavengers, algae, bacteria, and weather conditions such as rain, wind, water erosion, and sun exposure. This means that very few plants and animals actually become fossilized. Some scientists estimate that fewer than 2% of plant or animal species that lived on Earth have ever become fossilized.

Fossils teach us not only about the plants and animals of the past but also about the Earth’s topography and climate change. Paleontologists may find tropical plant fossils in modern-day deserts or fossils of sea creatures in a modern-day farmland. These discoveries give us clues about how those places have changed over time in climate and topography. Fossils help us piece together the long history of Earth and its inhabitants.

engage

Draw a Dinosaur

Pass out blank sheets of paper or scrap paper to students. Tell the students that you want them to use a pencil to draw a picture of a dinosaur. Ask students to put as much detail in their pictures as they can. Give the students several minutes to complete this activity. Refrain from answering any questions students may ask about dinosaurs during this time, such as “How big is a dinosaur?” You want the students’ thoughts to be their own impression of what a dinosaur is and looks like.

Once the students have had time to complete their drawings, have the students sit in a circle holding their drawings out for everyone to see. As the students look at each other’s drawings, ask them to raise their hands if they have ever seen the dinosaur they’ve drawn in real life. If students do raise their hands, ask them to clarify when they saw the dinosaur. Many students may say at the museum or on TV, but point out that they have never seen a dinosaur alive with their own eyes. Ask

? If you’ve never seen the dinosaur you drew, how did you know what it looked like? (Students

may say that they saw it at the museum, in a book, on the internet or on TV.)

- ? How do you think people who make museum displays or write books about dinosaurs know what they looked like? (They use fossils to study what the animals long ago looked like.)

Fossil Read-Aloud

Show the students the cover of the book *Fossil* and ask what they see on the cover. Explain that the animal on the cover was *Ornithocheirus* (Or-NITH-oh-KAI-rus), which was a reptile very similar to modern seafaring birds like pelicans or seagulls. Ask the students what they see drawn below the water. This is a picture of the remains of the animal. This is its fossil.



Making Connections: Text-to-Self

Tell students that as a child Claire Ewart, the author of this book, lived near a lake where she often found bits of fossils. You may want to read the jacket flap inside the back cover of the book with more information about the author. *Ask*

- ? Have you ever found a fossil?



Questioning

Connecting to the Common Core Reading: Informational Text

KEY IDEAS AND DETAILS: 3.1, 4.1, 5.1

As you read the book aloud, including the end matter titled “Fossil Evidence,” stop and *ask*

- ? Where did this animal live? (on an island)



OBSERVING FOSSILS

- ? What kinds of food did this animal eat? (fish)
- ? What happened to *Ornithocheirus* when it died? (It sank into the silt at the bottom of the sea.)
- ? Why didn't its body rot (decompose)? (Lack of oxygen at the bottom of the sea protected it from completely decomposing.)
- ? How did the animal become fossilized? (Minerals seeped in to replace the bones.)
- ? Where was the animal's fossil found? (on land) How did the Earth change after the animal died? (The sea is now land.)
- ? What caused the fossil to be exposed? (Heat, cold, wind, sun, ice, and rain wore away the ground.)

explore

Observing Real Fossils

Pass around some real fossils for students to explore. While students are examining the fossils, *ask* guiding questions such as

- ? What type of animal or plant do you believe your fossil might have been? What evidence makes you think that?
- ? Do you think this animal or plant lived in the ocean or on land? Why do you think so?

- ? How do you think this fossil was formed?

Card Sequencing (Before Reading)

Tell the students that you have a set of cards to give them. Each card has a step that a prehistoric animal may have gone through to become fossilized. Explain that they should try to put the steps in the order that they would most likely happen. Give each group a set of fossil formation cards and allow them time to put the steps in order, and then bring the class back together. Discuss how they sequenced the cards and why.



SEQUENCING THE FOSSIL CARDS

explain

Fossils Tell of Long Ago Read-Aloud

Connecting to the Common Core Reading: Informational Text

INTEGRATION OF KNOWLEDGE AND IDEAS: 3.9, 4.9, 5.9

KEY IDEAS AND DETAILS: 3.3, 4.3, 5.3

Show students the cover of *Fossils Tell of Long Ago* and introduce the author and illustrator. Explain that this is a nonfiction book that will tell them more about how fossils are formed and the things that we can learn by studying fossils. As they are listening, they will get clues as to how their fossil cards should be ordered.

Making Connections: Text-to-Text

Read the book aloud to the class, stopping at page 12 to *ask*

- ? How does this book's information compare with what we read in our last book, *Fossil?* (In both stories the animal died underwater, was buried in the sand, and was found millions of years later.)

Questioning

Ask

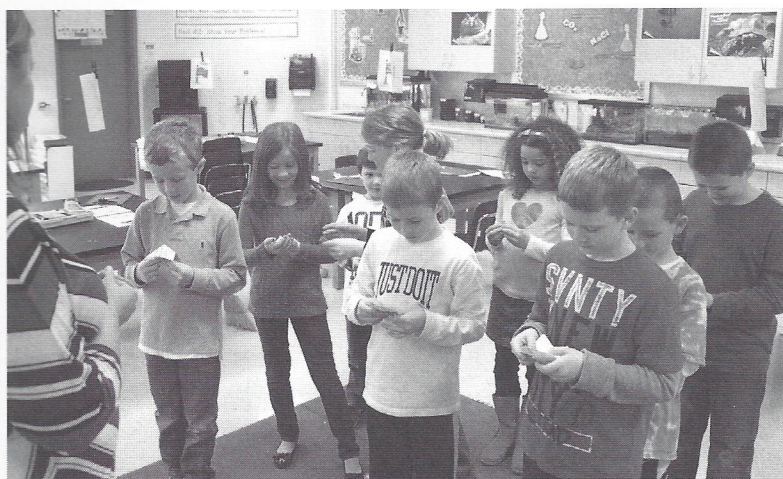
- ? Do you think all fossils were buried under water? Where else might they have been buried?

Continue reading the story and stop after reading page 21 to clarify that fossils can be formed in mud, ice, stone, and amber.

Card Sequencing (After Reading)

Once you have finished reading the book aloud, have the students go back to their places with their groups and use what they have learned to reorder their fossil formation cards. Then discuss the correct order and have them rearrange their cards if necessary. The correct order is as follows:

1. The animal is alive and swimming in the sea.
2. The animal dies and sinks to the bottom of the sea.
3. The soft parts of the animal rot away.
4. The animal's bones are left on the seafloor.



PLAYING THE FOSSIL GAME

5. The skeleton of the animal is buried in the mud on the seafloor.
6. Over a very long time, more and more mud is piled over the animal.
7. Over a very long time, the animal's bones are slowly replaced with stone.
8. The animal becomes a fossil.
9. The fossil is discovered.

Ask

- ? What things can we learn from fossils? (sizes and shapes of once-living plants and animals)
- ? What things can't we learn from fossils? (colors or patterns of once-living plants and animals)

Explain to students that, in order to make their best guesses about what colors and patterns prehistoric animals and plants had, scientists compare them with similar animals and plants that are alive today. But no one knows for sure exactly what they looked like.

elaborate

The Fossil Game

Ask

- ? How common do you think it is for plants and animals to become fossilized?

Explain to the students they are going to play a game to further investigate the probability or likelihood of a plant or animal becoming fossilized. Distribute templates 1, 2, and 3 of the Fossil Fortune Teller evenly among students. Using the How to Make a Fossil Fortune Teller student page, have the students cut and fold the Fossil Fortune Tellers. You may want to read the steps together and model them for the class or make them ahead of time.

Tell the students they are going to pretend that they are a prehistoric organism that has died and that they may undergo a number of different fates: some will become fossils, while others will be eaten, washed away, or decayed over time. Say, "We will begin our game with everyone standing. If you become a fossil, you will remain standing, but if you do not become fossilized you will sit down." Next, project an image of The Fossil Game Data Table. Tell students that throughout the game you will keep track of the results using this data table.

Directions for The Fossil Game (see also The Fossil Game Board):

1. Have the students stand up and spread out in the classroom holding their assembled fortune tellers.
2. Record the number of students in the class in the "Number of Organisms" column.
3. Hold the die about an inch above the star on the game board and drop it.
4. Call out the number that lands face up, and instruct the students to open and close their fortune tellers that many times.
5. Call out the letter that the die landed on. Have the students open that panel under the corresponding letter to discover their fate. If they became a fossil, they should remain standing, otherwise they should sit down.
6. Count the number of students who are standing and record that number in the "Number of Fossils Formed" column of the data table.
7. Have everyone stand for the next round. The game ends after five rounds.

NOTE: The purpose of this game is not to come up with a definitive fraction of organisms that become fossils; rather, it is to demonstrate the idea that most living things never become fossils because conditions aren't just right. As students read the statements on the fortune tellers they learn the reasons why.

Once the game has ended, add up the number of students who were fossilized in each round and then add up the number of students who played the game. For example, if 25 students played the game and in each round one student became fossilized, the final results would show that out of 125 organisms only 5 fossils formed.

Discuss the results of the game. Explain to the class that it is not very likely for a fossil to be formed because the conditions have to be just right. In fact, most ancient living things never became fossils. The organism had to have been preserved in ice, rock, amber, or mud quickly after its death so that it would not be eaten, washed away, or decayed.

evaluate

Fossil Rereading and I Found a Fossil Writing Activity



Writing

Connecting to the Common Core
Writing

TEXT TYPES AND PURPOSES: 3.3, 4.3, 5.3



Rereading

Reread the book *Fossil* by Claire Ewart. Have students pay special attention to the details and

scientific information about *Ornithocheirus* that the author reveals through the story. Explain that this type of book, known as a narrative informational book, communicates a sequence of factual events over time within the context of a story. The author begins the story with the girl finding a fossil and then describes the life and death of the animal. Finally, she describes how it became a fossil and was discovered by the little girl. Point out that this story follows a circular pattern, beginning and ending with the girl finding the fossil. Tell students that they will be writing their own narrative information about one of the fossils they observed earlier in this lesson and they will use this circular format for their story.

Give each student a copy of the I Found a Fossil journal, an animal fossil, colored pencils, and the scoring rubric. Tell students the name of their fossils if they are not labeled. Provide resources for your students to research information about their animals such as when the animal lived, what its habitat was like at the time, and what and how it ate.

Have students share their stories with a partner or the class. Use the scoring rubric to evaluate their books.

Websites

American Museum of Natural History "Fossil Halls"
<http://www.amnh.org/exhibitions/permanent-exhibitions/fossil-halls>

"Paleontology: The Big Dig"
www.amnh.org/explore/ology/paleontology

BBC "Science and Nature: Prehistoric Life"
www.bbc.co.uk/sn/prehistoric_life/games

More Books to Read

Aliki. 1988. *Digging up dinosaurs*. New York: HarperCollins.
Summary: This *Let's-Read-and-Find-Out Science* book gives young children a look at how dinosaurs lived millions of years ago and how scientists learn about them from the fossils they left behind.

Jenkins, S. 2005. *Prehistoric actual size*. Boston: Houghton Mifflin.
Summary: The author's trademark paper collage illustrations depict a variety of prehistoric animals

Inquiry Place

Have students brainstorm questions about fossils. Examples of such questions include

- ? What types of fossils, if any, can be found in the area where you live? Research it!
- ? Are there certain places on Earth that have more fossils than others? Why? Research it!
- ? What type of rock are fossils found in? Research it!

Have students select a question to investigate or research as a class, or have groups of students vote on the question they want to investigate or research as a team. You may want to direct students to the "PaleontOlogy: The Big Dig" section of the American Museum of Natural History website to do their research and come up with more questions. Students can present their findings at a poster session or gallery walk.

at their actual size. For each featured animal, the book includes some characteristics, how long ago it lived, and its length.

Kudlinski, K. 2005. *Boy, were we wrong about dinosaurs!* New York: Dutton Children's Books.

Summary: Examines what is known about dinosaur bones, behavior, and other characteristics, and explains through specific examples that our ideas about dinosaurs have changed as more evidence has been discovered.

Squire, A. 2012. *Fossils*. Chicago: Children's Press.

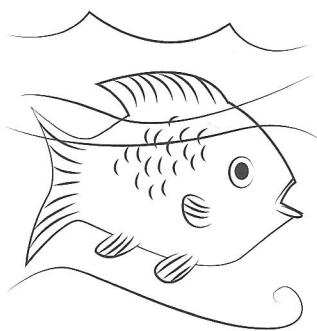
Summary: This book is a part of the *True Books* series that focuses on fossil formation and the information paleontologists get from the study of fossils.

Zoehfeld, K. W. 2008. *Finding the first T. rex*. New York: Random House Books for Young Readers

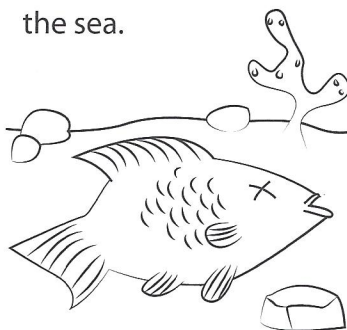
Summary: This book explores the work of a famous paleontologist, Barnum Brown, as he uncovered the first discovered *Tyrannosaurus rex* remains.

Fossil Formation Cards

An animal is alive and swimming in a sea.



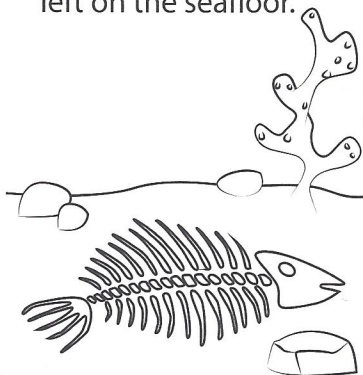
The animal dies and sinks to the bottom of the sea.



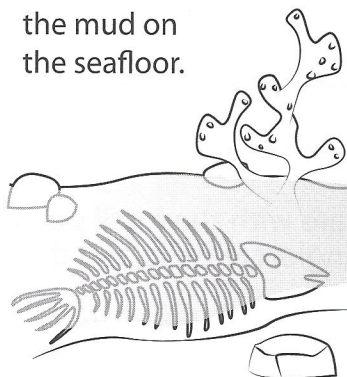
The soft parts of the animal rot away.



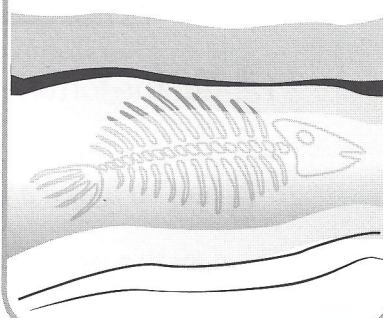
The animal's bones are left on the seafloor.



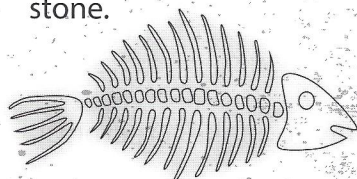
The skeleton of the animal is buried in the mud on the seafloor.



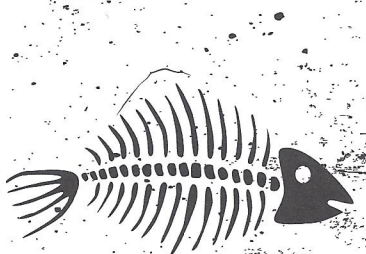
Over a very long time, more and more mud is piled over the animal.



Over a very long time, the animal's bones are slowly replaced with stone.



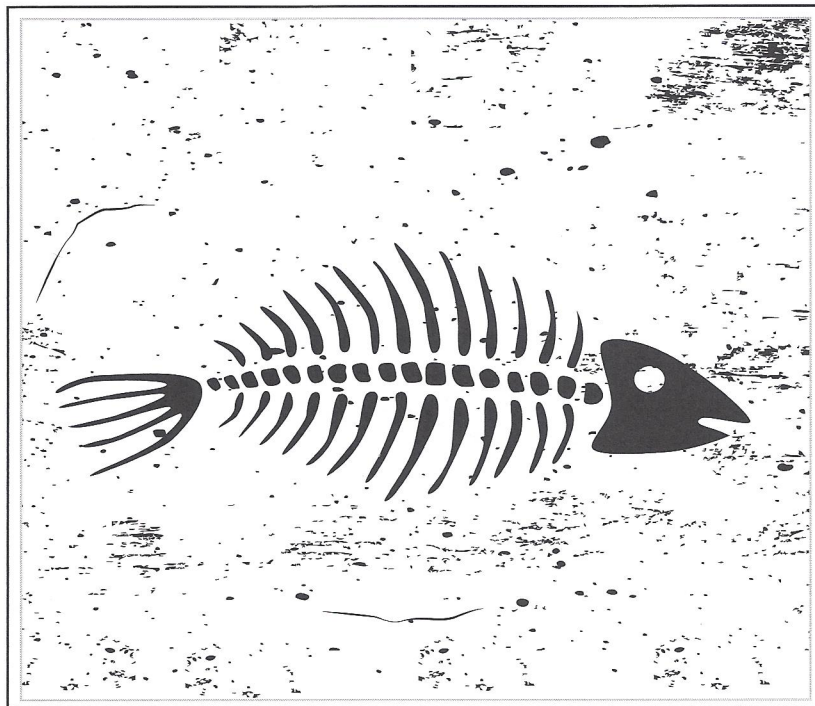
The animal becomes a fossil.



The fossil is discovered.



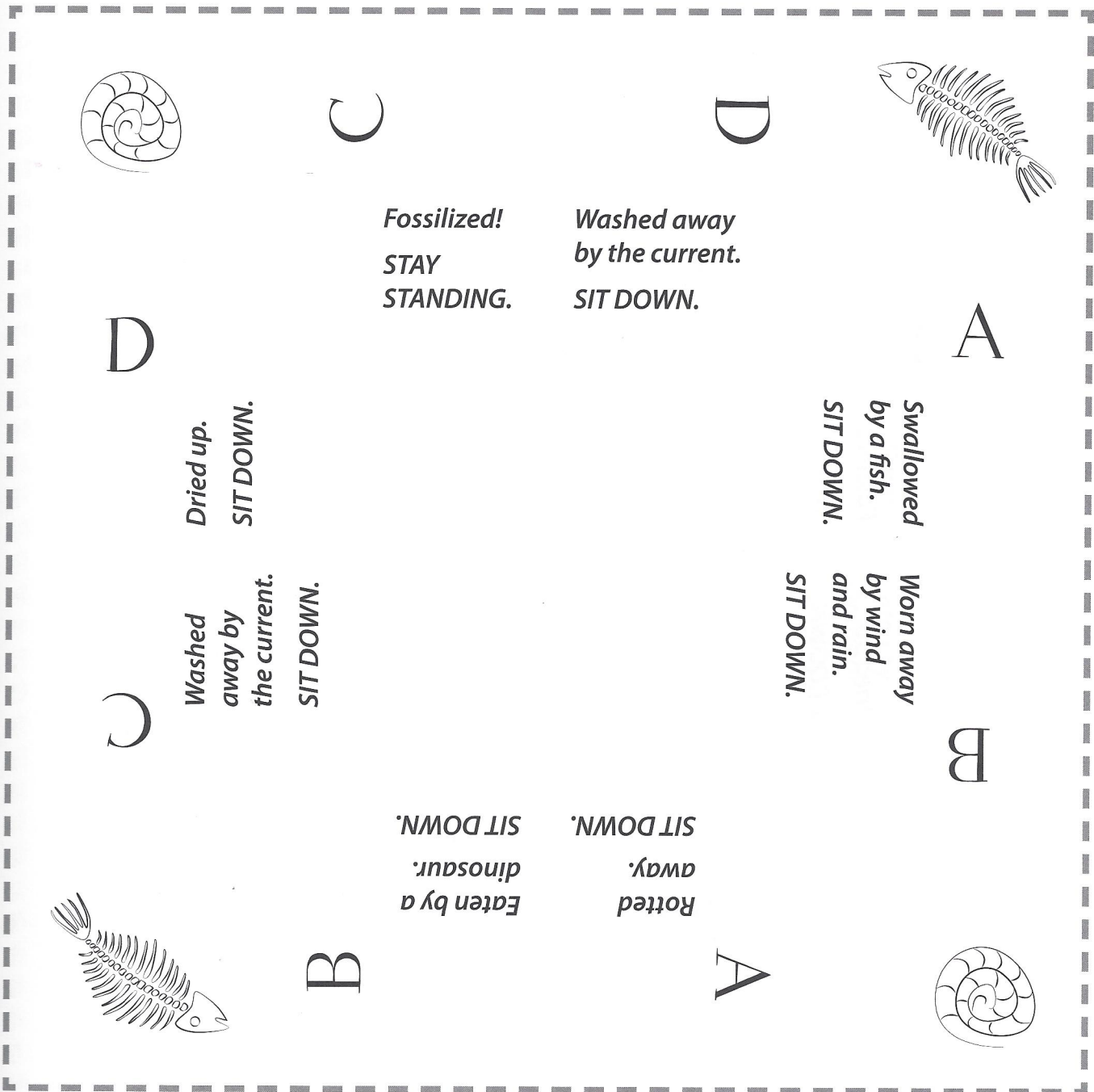
How to Make a Fossil Fortune Teller



1. Cut the fortune teller template to make a square.
2. Lay the paper square with the fossil side down. Fold the square in half to make a triangle, crease it, and then open it back up.
3. Lay the paper square fossil side down again. Fold the other corners into a triangle and crease again. Unfold so that the fortune teller is a square again (fossil side down).
4. Fold each corner point into the center of the creases.
5. Flip it over (fossil side down). Fold all four corner points into the center once again.
6. Fold the square in half to make a rectangle and crease it.
7. Open it back up to the square. Fold the other way to make a rectangle and crease it.
8. Stick your thumbs and two forefingers into each of the four bone flap pockets. Fingers should press center creases so that all four flaps meet at a point in the center.

Fossil Fortune Teller

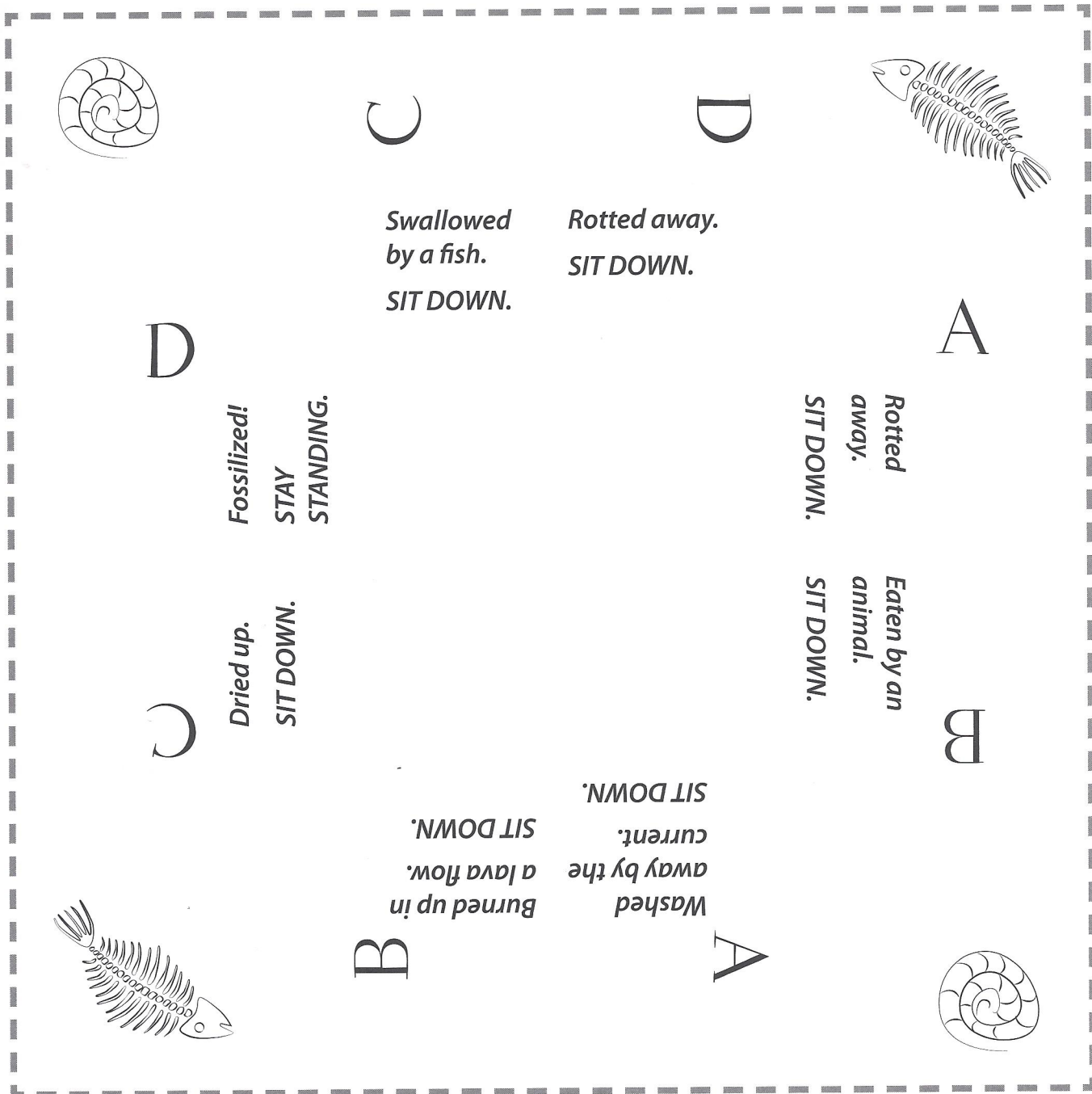
Template 1



Cut off at the dotted line to make a square.

Fossil Fortune Teller

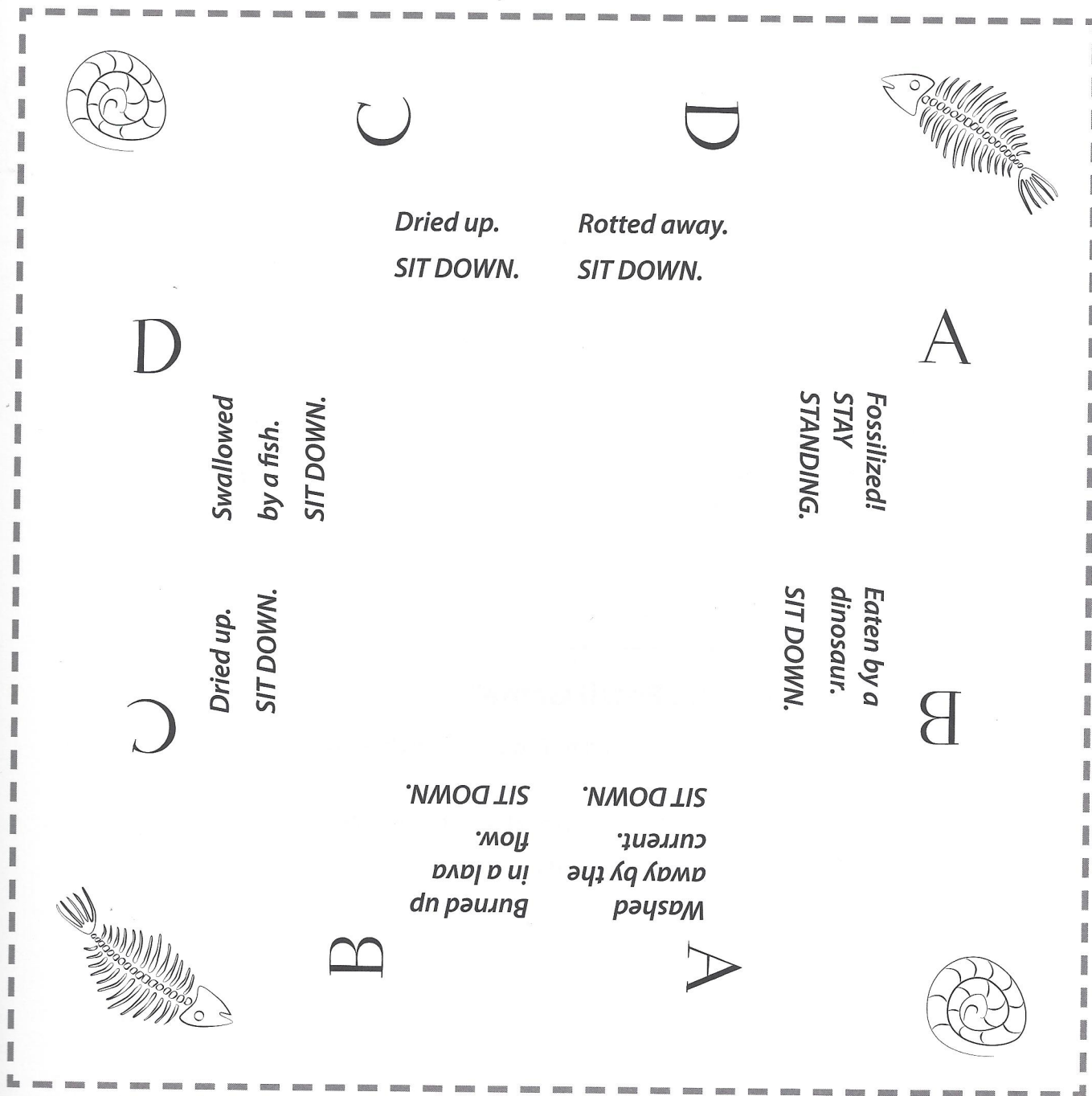
Template 2



Cut off at the dotted line to make a square.

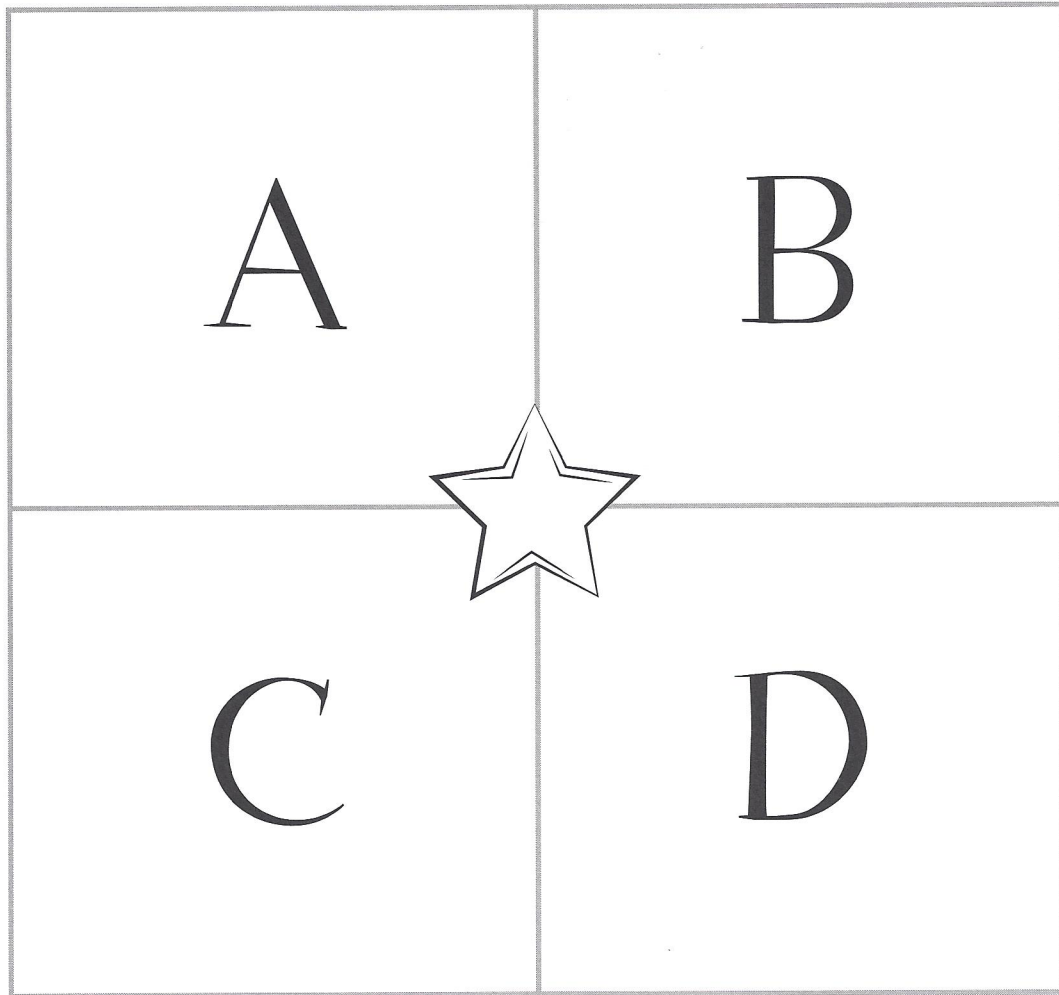
Fossil Fortune Teller

Template 3



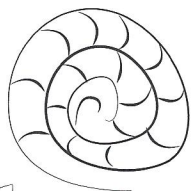
Cut off at the dotted line to make a square.

The Fossil Game Board

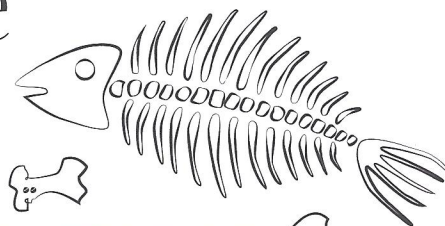


How to Play "The Fossil Game"

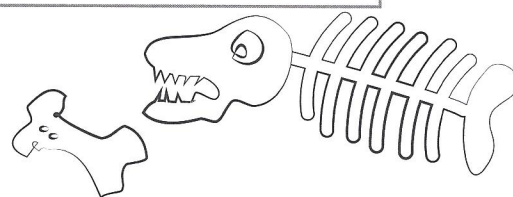
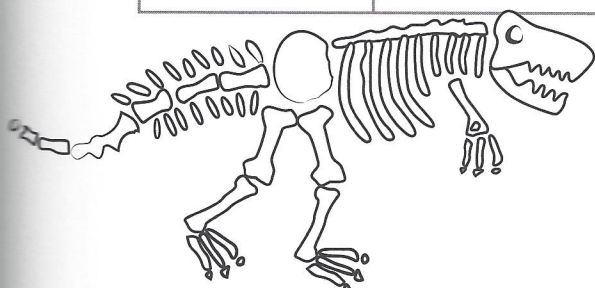
1. Have the students stand up and spread out in the classroom holding their assembled fortune tellers.
2. Record the number of students in the class in the "Number of Organisms" column.
3. Hold the die about an inch above the star on the game board and drop it.
4. Call out the number that lands face up, and instruct the students to open and close their fortune tellers that many times.
5. Call out the letter that the die landed on. Have the students open that panel under the corresponding letter to discover their fate. If they became a fossil they should remain standing, otherwise they should sit down.
6. Count the number of students who are standing and record that number in the "Number of Fossils Formed" column of the data table.
7. Have everyone stand for the next round. The game ends after five rounds.



The Fossil Game Data Table



Round	Number of Organisms	Number of Fossils Formed
1		
2		
3		
4		
5		
	Total Number of Organisms:	Total Number of Fossils Formed:



I found a stone that once was

Page 1

Page 6

I Found a FOSSIL

By _____

Page 5

Page 2

Page 4

Page 3

I Found a Fossil

Scoring Rubric

Research an energy resource used to produce electricity.
Include the criteria listed below on your poster.

4-Excellent **3-Above Average** **2-Average** **1-Below Average**

Score	Criteria
_____ 4 _____ 3 _____ 2 _____ 1	Cover: Your name and a detailed drawing of the fossil
_____ 4 _____ 3 _____ 2 _____ 1	Page 1: The name of the fossil in the sentence ("I found a stone that once was _____.") and an illustration of you discovering the fossil
_____ 4 _____ 3 _____ 2 _____ 1	Page 2: A description and illustration of what the animal looked like when it was alive
_____ 4 _____ 3 _____ 2 _____ 1	Pages 3 & 4: Descriptions and illustrations of the animal surviving in its habitat (What did its environment look like at the time? How did it move, get food, escape from predators? and so on)
_____ 4 _____ 3 _____ 2 _____ 1	Page 5: A description and illustration of how the animal became fossilized
_____ 4 _____ 3 _____ 2 _____ 1	Page 6: A description and illustration of how the fossil was uncovered and discovered by you

_____ **Total Points/24**