Think like Ascientist Fish Out of Water

"Bookst Clds

TEACHER'S GUIDE



Readers investigate a world map and zoom in on the Wadi Al-Hitan in Egypt, Africa, to initiate thinking about what they may already know about the location. They make predictions about what Kat might find at the Wadi Al-Hitan.

Make a Prediction

What kind of fossils do you think Kat will see at the Wadi Al-Hitan?

This question is designed to engage readers in thinking about the topic, and there is no single correct answer. Encourage discussion. It is essential for readers to ask questions in order to develop scientific habits of mind and it is an important component of science literacy. Students at this age should be able to ask questions of each other about texts or features they observe and conclusions they draw. The purpose of an elicitation discussion like this is to uncover students' prior experience or knowledge about a topic and pique their interest in new learning. It will also provide you with insight into their thinking.

You may want to collect all of the students' ideas so that they can be revisited at a later time.

English Language Arts Connection: Speaking and Listening

There is solid research evidence that academically productive talk is essential for learning in science. These ground rules from "Talk Science Primer" will help you begin and maintain productive discussions in your classroom (also refer to the Student Discourse section earlier in

English Language Arts Connection: Speaking and Listening

In a data discussion such as this, help students focus on the data that is relevant to the investigation. Start with an open, clear framing question and follow up with questions that will help keep the discussion focused. It is more important that you support and guide the conversation rather than tell or ask students to recite facts. Always give students time to think and encourage them to dig deeper by asking questions like, "Can you say more about that?" or, "Was there something on the map that made you think that?" Encourage participation with questions like, "Who can rephrase what Sheila just said in your own words?" or, "Do you agree or disagree with Sheila?"

Guiding Questions for Classroom Discussion

- Is the Wadi Al-Hitan wetter or drier than where you live? Warmer or cooler? (Answers will vary.)
- What does the word average mean? (typical, common, central)
- How do you determine an average? (In math, you find an average by adding a group of figures together and then dividing the sum by the number of figures you have added.)
- What is precipitation? (the falling of water from the sky in the form of rain, sleet, hail or snow)
- What is temperature? (the degree of heat or cold in something)
- What information would you need to know to calculate the average annual precipitation or temperature? (the amount of precipitation or temperature per day and the number of days in a year, or the amount of precipitation or temperature per month and the number of months in a year)

Mathematics Connection

Help your students understand the concept of average (finding the mean) with this activity. Average is a calculated central value of a set of numbers. To calculate the average, add up all the numbers (sum), then divide by how many numbers there are (count). Another word for average is *mean*. How does this work? It's like flattening, or leveling, the numbers.

See Appendix C for a reproducible worksheet, A Mean Machine, and answer key with notes for discussion.

CCSS Mathematics MP.2 (Reason abstractly and quantitatively) and MP.4 (Model with mathematics)

Differention Acitvity

Take into consideration the math abilities of the students you are working with before you begin the Mathematics Connection activity. You know the students you teach best. Are they proficient with decimals and double-digit long division? You may choose to pose different questions depending on your students' skills.

Sanaa El-Sayed is a paleontologist. She discovered a new ancient fish **species** in the Wadi Al-Hitan. It is a large catfish about 6.5 feet (over 2 m) long. It would have lived nearly 40 million years ago. The fish has been named *Qarmoutus hitanensis*.



Readers investigate photos and informational text that reveal real-world details about the actual discovery of Qarmoutus hitanensis at the Wadi Al-Hitan. The paleontologist who uncovered the fossil tells readers about how she became interested in paleontology and what she enjoys about her work.

Vocabulary

Paleontologist: A scientist who studies the fossils of animals and plants that lived very long ago.

Species: A group of related animals or plants.

Teacher's Note

A common misconception is that boys and men are more naturally inclined to be interested and successful in the sciences than girls and women. The main character in this book is a young girl. In a February 18, 2005 NSTA Reports article entitled "Achieving Gender Equality in the Science Classroom," Anne Tweed asks science educators to "select curriculum materials that present culturally diverse male and female role models working in all disciplines and at all levels of science." It is our responsibility to "provide all students with the most recent information about the kinds of opportunities available in the sciences, as well as the preparation necessary to attain such careers." Teachers create equitable learning environments by articulating the clear message that all students can learn science. The purposeful inclusion of this kind of example can

Chapter 2

Explore the Wadi Al-Hitan

In this chapter, Kat shares her impressions of the Wadi Al-Hitan by way of another Kat Chat and invites readers to investigate the desert and its interesting rock formations.

By the end of the topic, students will be able to:

- use a layer model to describe the rock formations at the Wadi Al-Hitan and predict what caused them to form this way;
- construct an explanation about what has caused the Earth's landscape to change over time; and
- gather relevant information from print and digital sources.

talking, they can begin to see ideas from more angles and make links to other concepts they already understand. The discussion will take off and become exhilarating for the students and for you, too.

Guiding Questions for Classroom Discussion

- How do you think these rocks formed? (Answers will vary.)
- Why do you think there are layers? (Answers will vary.)
- Where have you seen a pattern like this? (Answers will vary.)
- What does it remind you of? (Answers will vary.)
- In what order do you think the rock layers were created? (Answers will vary.)
- Which layer do you think is the oldest? Youngest? (Answers will vary.)

English Language Arts Connection: Writing

Consider revisiting the CER framework and have your students write down and sketch their ideas on paper, white boards, or in interactive science notebooks.

Claim	Evidence	Reasoning
Give an answer to the question.	What evidence supports your claim?	Explain how your evidence supports your claim.
I think these strange shapes were formed by 	Based on other patterns like this I've seen	I think these shapes were formed when because

Hands-On Activity

Students will work with a partner to model how rock layers might form.

Safety Notes

- 1. Follow all safety notes from the beginning of the teacher's guide.
- 2. All students must wear safety glasses.

Materials

- Several colors of modeling clay
- Paper plates

Procedure

- 3. Choose one lump of clay and flatten it into a layer on your paper plate.
- 4. Choose another color of clay. Flatten it into a layer and press it on top of your first layer.

Example T-chart:

	Weathering (break)	Erosion (take)
•	Large rocks are broken into small pieces by:	 The movement of pieces of weathered rock by: Running water Wind Waves Glaciers It takes a long time to happen

Hands-On Activity

Erosion is a slow, yet powerful, force of nature. The Grand Canyon is an extreme example of the effects erosion can have on its surroundings. It took millions of years, but the Colorado River wore away inch after inch of the Arizona desert, producing the canyon. Help your students visualize the effects that wind and water can have on Earth with this simple model.

Safety Notes

- 1. Follow all safety notes from the beginning of the teacher's guide.
- 2. All students must wear safety glasses.
- 3. Make sure students keep straws a couple of inches away from the sand. If you are concerned about students irresponsibly blowing sand, you may want to do the wind part of this activity as a teacher demonstration only.

Materials

- Safety glasses
- Sand or soil
- Paint trays
- Straws
- Small battery-operated fans
- Small watering cans
- Cup or bottles

Procedure

- 1. Position sand or soil in the upper half of a paint tray, leaving the bottom reservoir empty.
- 2. To demonstrate wind erosion, gently blow across the top to represent wind. Try blowing through a straw to represent a focused air stream or using a small battery-operated fan to show the effects of constant wind over time.
- 3. Repack the sand or soil as needed.



Readers analyze rock layer sample diagrams. Using their knowledge of patterns and the causes and effects of weathering and erosion, they interpret which fossil is the oldest and which rock layers are most likely the same age. They learn that they can use the Law of Superposition, which states that a layer of rock below another layer of rock will be older if the layers have not been disturbed. In addition, they determine that layers C and 1 were formed during the same period because they contain the same plant fossil and no other layers have that fossil.

Vocabulary

Law of Superposition - in any undisturbed sequence of rocks deposited in layers, the youngest layer is on top and the oldest on bottom, each layer being younger than the one beneath it and older than the one above it

Background Information

William Smith created the first geologic map in 1815 in England when he realized that certain rock layers contained certain types of fossils and that the older the rock, the more primitive the fossil forms that were present. In France, Georges Cuvier built upon Smith's results and suggested that rocks containing similar fossils in France were the same age as those in England. This was the beginning of the idea that certain types of fossils existed for a specific period of time in Earth history and that the layers of rock bearing these fossils could be correlated, even



Readers compare Eocene fossils with their modern-day relatives using another drag and drop activity. They begin to reconstruct the ancient environment when they learn more details about some plants and animals that lived in the area along with the newly discovered catfish. Through this activity and the last, readers interpret the structure of these animals and plants to determine that they function as marine organisms. So the environment that is now a desert must have been an aquatic environment at one time, most likely saltwater.

Make a Prediction

What do all the plants and animals in these photos have in common?

Encourage discussion in order to uncover students' prior experience or knowledge about the topic and pique their interest in new learning.

English Language Arts Connection: Speaking and Listening

If necessary, call attention to the highlighted vocabulary in the pop-up information shown below. It will help readers become aware that these are all marine organisms, which means the environment that is now a desert must have been an ocean at one time. It is important for readers to come to this conclusion.

• Sea turtles live in ocean basins all over the world. They nest on beaches and migrate long distances to feed. They usually stay close to the shore, coral reefs, and rocky areas.

CHAPTER 5: Think Like a Paleontologist

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Kat congratulates readers on a job well done.

Readers are challenged to participate in more investigations. What other mysteries can they solve? They should look around them and ask questions about what they see. Encourage them to always share what they've learned with others. Maybe someday they can go with Kat on another Kat-venture!

Three-Dimensional Activity

This hands-on activity incorporates the skills and knowledge readers have acquired throughout this book. Students work in small groups to apply their understanding of how paleontologists use evidence to determine what an ancient environment was like. They demonstrate their learning by modeling rock layers, analyzing layer models, and making a claim about evidence for change over time.

See Appendix G for a reproducible worksheet, Layer by Layer, and answer key with notes for discussion.

Safety Notes

- 1. Follow all safety notes from the beginning of the teacher's guide.
- 2. All students must wear safety glasses.