

TEACHER'S GUIDE

Trailblazer (Grade 3)

Vol. 16 No. 5



In This Guide

This guide contains language arts and science lessons for articles in this issue of EXPLORER TRAILBLAZER.

Explorer Magazine

EXPLORER classroom magazines are specifically written for each grade, 2-5. Through great storytelling and stunning photographs, the EXPLORER magazines develop literacy skills and teach standards-based science content.

The EXPLORER magazines strive to offer a variety of reading experiences for students with different ability levels in the same class. Thus, all articles have been measured using the Lexile® Framework for Reading. Some articles will be easier to read than others, but all articles in EXPLORER TRAILBLAZER will be within the 350-750L range.

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The Four That Roar

LANGUAGE ARTS



Objectives

- Students will assess their familiarity with and knowledge of vocabulary words.
- Students will use information from the text, photos, and a map to understand the four big cats that roar.
- Students will explain concepts based on information in the text.

Resources

- Vocabulary Assessment Master (page 6)
- Language Arts Assessment Master (page 7)

Summary

- The article “The Four That Roar” introduces students to four big cats—lion, leopard, jaguar, and tiger that share one unique trait: They roar.

BUILD VOCABULARY AND CONCEPTS

- **adaptation**
- **conservationist**
- **poach**

As a class, discuss the difference between familiarity and knowledge. Guide students to recognize that the more familiar you are with something, the more knowledge you have. Challenge students to explain how this concept applies to words when they read.

Display the vocabulary words on a word wall or on the whiteboard. Give each student a copy of the **Vocabulary Assessment Master**. Instruct students to write each word on their papers. Review the categories under the header “Familiarity with the Word.” Tell students to make a checkmark to indicate how well they know each word.

Instruct students to write what they think each word means on their worksheets. Then display the Wordwise feature on page 9 of the projectable magazine. Have students write those definitions on their worksheets and compare them with the definitions they wrote.

READ

Inform students that the purpose of this article is to introduce them to four big cats that share one unique trait. They are the only cats that can roar.

Display pages 2-3 of the projectable magazine. Invite a volunteer to read aloud the headline and the text in the upper right corner of the screen. Have students raise their hands if they think they can identify the four big cats that roar. **Say:** *Neither the headline nor the text identified these four big cats.* **Ask:** *Where did you get this information?* (the photos) Point out to the class that when people read, they usually focus on the words. But words aren't the only way to get information. Photographs and other text elements can be helpful, too.

Inform the class that these photos show a lion, a tiger, a leopard, and a jaguar. **Say:** *The lion and tiger are easy to identify. But the leopard and jaguar are easy to confuse.* Point out that adding labels would have made it easy to identify these big cats, too.

Say: *Many times, readers can get information from photos, captions, maps, and other text elements in an article. That information can quickly answer some of the questions they have.*

Give each student a copy of the **Language Arts Assessment Master**. Have students read the article in small groups. As they do, instruct them to use the text, photos, and map to learn about the four big cats that roar.

The Four That Roar

LANGUAGE ARTS

TURN AND TALK

Have students turn and talk to discuss what they learned about the four big cats that roar. **Ask:** *What are the four cats that can roar?* (lion, leopard, jaguar, and tiger) *Why do they roar?* (They each have a missing bone in their voice boxes. In its place is a band of stretchy tissue.) *What sound would they make if they had that missing bone?* (They would purr.) Invite students to share what else they learned about the four big cats that roar.

- **Integrate Information** After reading the article, have students share their **Language Arts Assessment Masters** in small groups. Instruct students to compare the information they recorded. Have students discuss how using text, photos, and the map helped them learn about the four big cats that roar. As a class, identify other sources that could help them learn even more about the big cats.

- **Explain Concepts** After reading the article, **say:** *One way to see if you understand information is to try to tell someone else about the topic. If you can't explain the concept, you might need to read the article again.* Have students turn and talk to explain to a partner why these big cats hunt. Prompt discussion with questions such as: *What do these big cats eat?* (other animals) *How do you know that?* (They're carnivores. All carnivores eat meat, which comes from other animals.) *How do they get their food?* (They hunt. This is how they find and catch their prey.)

WRITE AND ASSESS

You may want students to write about what they learned to assess understanding. Encourage students to reflect upon what they read and how it affected their ideas about the topic.

- *Why is "built to hunt" a good description of the four big cats that roar?*
- *What is a conservationist? How do conservationists help big cats?*
- *What surprised you about what you read?*

The Four That Roar

SCIENCE

Objectives

- Students will compare and contrast the four big cats that roar.
- Students will identify traits that make other cats feared hunters in their habitats.
- Students will understand how habitat loss leads to conflicts between big cats and humans.

Resources

- Content Assessment Master (page 8)
- "The Four That Roar" poster (Teacher's Edition)
- "Know Your Cats" poster (Teacher's Edition)
- Comprehension Check (page 9)
- "The Four That Roar" Interactive Whiteboard (optional)

Science Background

Big cats are the indisputable leaders in their domains. As apex predators, they reign at the top of the food chain. By limiting the number of plant eaters and preying on the sick, they keep their habitats healthy and their ecosystems in check.

Lions, tigers, jaguars, and leopards are four of the most fearsome predators. In addition to being outstanding hunters, they are the only four big cats that can roar. This is possible because they all have a missing a bone in their voice boxes.

Despite their status, these four big cats—like all other big cats around the world—are in danger of becoming extinct. One major problem they all face is the loss of habitat. As people clear land for new homes and businesses, big cats' habitats shrink. Their closer proximity to humans leads to inevitable conflicts between the two species.

Some people kill big cats. Farmers do this when the cats prey on their livestock. And poachers kill so they can sell the cats' body parts. But other people are trying to save big cats. They teach people how to live beside the predators. They set aside land for big cats to live on. They work to ensure that all big cats can survive.

ENGAGE

Tap Prior Knowledge

Poll the class to see how many students have a pet cat. Invite a few volunteers to describe their cats. What do the cats look like? How do they behave? Challenge the class to explain how domestic cats are similar to or different from big cats that live in the wild.

EXPLORE

Preview the Lesson

Display pages 2-3 of the projectable magazine. Invite volunteers to describe the big cats they see. **Ask:** *What is one way these big cats are all alike?* (Possible response: They all have fur.) **Ask:** *What are one way they all are different?* (Possible response: Their fur has different colors and patterns.) Tell students that as they read the article they will learn more about the big cats that roar.

Set a Purpose and Read

Have students read the article in order to compare and contrast the four big cats that roar, identify traits that make other cats feared hunters in their habitats, and understand how habitat loss leads to conflicts between big cats and humans.

The Four That Roar

SCIENCE

EXPLAIN

Compare and Contrast Big Cats

Display the **"The Four That Roar" poster**. Review the poster with the class. Encourage students to identify similarities between the big cats. (Possible responses: fur, sharp teeth, claws, etc.) Challenge students to identify differences. (Possible responses: color and pattern of fur, size, and hunting habits) Then display the map on pages 6-7 of the projectable magazine. **Say:** *This map shows the big cats' approximate ranges, or the areas where they live. As you can see, their ranges are in different places.* **Ask:** *But what does the article tell you all of their habitats have in common?* (They're shrinking.) Give each student a copy of the **Content Assessment Master**. Divide the class into small groups. Instruct groups to review the article and the poster. Challenge them to compare and contrast the four big cats that roar.

Identify Traits in Other Cats

Display pages 4-5 of the projectable magazine. As a class, review the sections "Built to Hunt" and "Hunting Prey." Have students identify adaptations that help big cats catch prey. (Possible responses: long tails, claws, strong legs, etc.) Discuss how the cats use each adaptation. (Example: Strong leg muscles power long jumps and big steps.) Then display the **"Know Your Cats" poster**. Review the poster with the class. Challenge students to identify adaptations that make these cats fearsome hunters in their own habitats.

Understanding the Impact of Habitat Loss

Display the map on pages 6-7 of the projectable magazine. Remind the class that this map shows where big cats live. **Ask:** *Who else lives in these same places?* (people) Divide the class into small groups. Instruct groups to review pages 6-9 of the article in their student magazines. Then have students take out their **Content Assessment Masters**. Tell them to record reasons why big cats are losing their habitats, problems that causes, and solutions people have tried to help big cats survive.

ELABORATE

Find Out More

Point out to the class that the map on pages 6-7 shows the current ranges of the four big cats that roar. It does not show what their ranges were in the past. As a class, conduct research to learn more about these shrinking habitats. How large did they used to be? What specifically caused them to shrink?

Extend Your Thinking About Big Cats

Remind students that in 2009 the National Geographic Society launched the Big Cats Initiative. It supports scientists working to save big cats in the wild. As a class, brainstorm a list of ideas that could help the Big Cats Initiative save big cats.

EVALUATE

Have students record their answers to the assessment questions in their science notebooks or on a separate sheet of paper.

- *What is an adaptation?* (a behavior or body part that helps an animal survive)
- *What happens when big cats are poached?* (They are killed illegally for their body parts.)
- *How do photo safaris help save big cats?* (Travelers pay to see big cats up close. The money from tourists helps local people and makes the big cats worth protecting.)

If you wish, have students complete the **Comprehension Check** to assess their knowledge of concepts mentioned in the article. You may also wish to examine the optional **Interactive Whiteboard** lesson that accompanies this article.

Name _____

Date _____

VOCABULARY ASSESSMENT: The Four That Roar

Record information from the article about each vocabulary word.

Word	Familiarity with the Word			Knowledge of the Word	
	I know the word very well.	I've seen or heard the word before.	I don't know the word.	What I think the word means:	How the article defines the word:

Name _____

Date _____

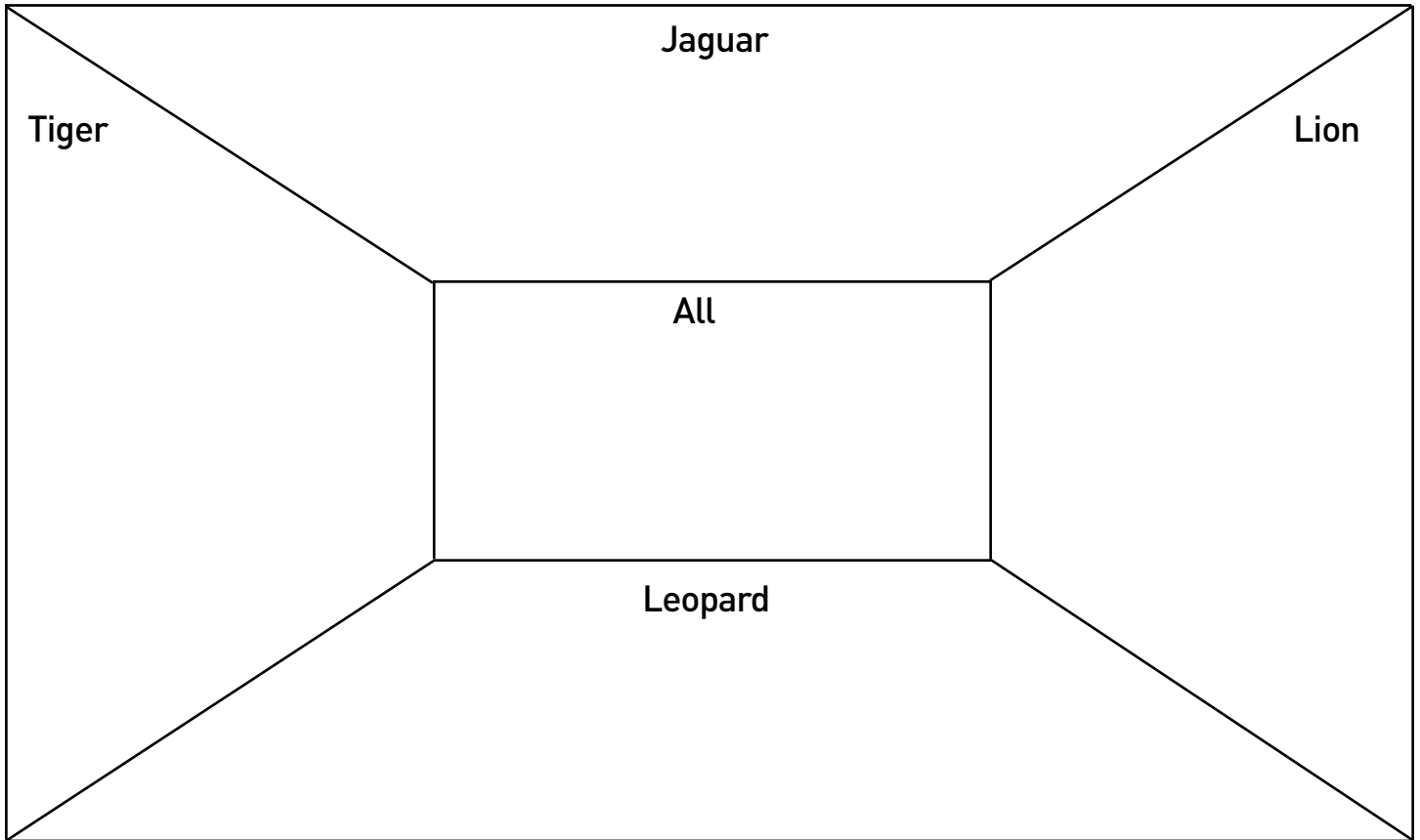
LANGUAGE ARTS ASSESSMENT: The Four That Roar

Use this organizer to record information about the four big cats that roar. Include facts from the text, photos, and map in the article.

	Text	Photos	Map
Big Cat			
Tiger			
Leopard			
Jaguar			
Lion			

CONTENT ASSESSMENT: The Four That Roar

Compare and contrast the four big cats that roar.



Record reasons why big cats are losing their habitats.

List problems that loss of habitat causes for big cats.

List solutions people have tried to help big cats survive.

COMPREHENSION CHECK: The Four That Roar

Read each question. Fill in the circle next to the correct answer or write your response on the lines.

- 1. Which big cat has light brown or tawny fur?
Ⓐ leopard
Ⓑ jaguar
Ⓒ lion

- 2. Which big cat lives in the rain forests of Central and South America?
Ⓐ tiger
Ⓑ jaguar
Ⓒ lion

- 3. Why are big cats losing their habitats?
Ⓐ People take over their land.
Ⓑ Wild animals live in their habitats.
Ⓒ They are killed illegally.

- 4. What kind of person works to protect big cats and their habitats?
Ⓐ a poacher
Ⓑ a conservationist
Ⓒ a reservist

5. Tell how photo safaris can help save big cats.

Mountains in the Sea

LANGUAGE ARTS



Objectives

- Students will explore the meaning of vocabulary words in a variety of different ways.
- Students will describe the process in which seamounts form.

Resources

- Vocabulary Assessment Master (page 14)
- Language Arts Assessment Master (page 15)

Summary

- The article “Mountains in the Sea” introduces students to seamounts, or mountains under the sea. Seamounts are one of the most common but least-known marine ecosystems in the world.

BUILD VOCABULARY AND CONCEPTS

- **biodiversity**
- **ecosystem**
- **seamount**

Read aloud each of the vocabulary words. As you do, poll the class to see how many students are familiar with each word. Then challenge volunteers to provide a scientific definition of each term.

Point out that this task was most likely easier with some of the words than others. **Say:** *As students, your vocabulary is constantly expanding. But many of the words you learn have multiple meanings. When reading about science, it's important to understand the scientific definition. And a great way to remember that more technical definition is to study the word in multiple ways.*

Give each student a copy of the **Vocabulary Assessment Master**. Divide the class into pairs. Instruct partners use this worksheet to explore the vocabulary words in four different ways: writing definitions, restating the definition in their own words, using the term in a sentence, and then drawing a picture to help them remember what the word means.

READ

Inform students that the purpose of this article is to introduce them to seamounts, one of the most common but least-known marine ecosystems in the world. As they read, they'll learn about how seamounts form and what it is like in a seamount ecosystem.

Inform students that as they read, they will notice relationships between ideas in the text. For example, processes have a beginning, middle, and end. Events in those processes occur in a specific order. In another type of relationship, one thing can cause something else to happen. Explain to students that finding and interpreting these relationships is the key to fully understanding how concepts are related in a text.

Have students read the article on their own. After reading, give each student a copy of the **Language Arts Assessment Master**. Instruct students to describe what happens when seamounts form. Remind them to list the events in the proper order. Then have students complete three cause/effect statements about seamounts. Instruct students to write a "C" above the cause in each sentence and an "E" above each effect.

Mountains in the Sea

LANGUAGE ARTS

TURN AND TALK

Have students turn and talk to discuss what they learned about seamounts. **Ask:** *What is a seamount?* (an underwater mountain formed by volcanic activity) *Why don't people know much about them?* (They are located far beneath the ocean's surface.) *What happens to ocean water at the summit of a seamount?* (It gets trapped in a spin.) *What happens then?* (Plants and animals that get trapped in the spinning water become food for ocean predators.)

- **Exploring Meanings** Inform students that it's essential for readers to understand the technical definition of words when reading about science. Without that knowledge, it's very difficult to understand the text. **Say:** *Once you do understand what scientific terms mean, not only can you follow along with the text but you can use the words correctly in new sentences of your own.* Challenge students to make accurate statements using each of the vocabulary words. Encourage them to use their **Vocabulary Assessment Masters** as resources. But remind them to be original. Students shouldn't restate sentences from the article. They should create new sentences of their own.

- **Describe Relationships in Concepts** Invite volunteers to describe a sequence of events and a cause/effect relationship. Review instances when writers might use either technique. Then have students review their **Language Arts Assessment Masters** in small groups. Encourage students to compare the information they recorded with one another as well as the text in the article. Instruct students to add any steps they missed in their sequence of events. Clear up any confusion regarding causes and effects related to seamounts.

WRITE AND ASSESS

You may want students to write about what they learned to assess understanding. Encourage students to reflect upon what they read and how it affected their ideas about the topic.

- *How do nutrients from the ocean floor get to the top of a seamount?*
- *Why is it important to protect seamount ecosystems?*
- *What surprised you about what you read?*

Mountains in the Sea

SCIENCE

Objectives

- Students will recognize where seamounts form.
- Students will understand how seamounts create unique ocean ecosystems.
- Students will identify reasons why seamounts are one of the most common yet least explored ecosystems on the planet.

Resources

- Content Assessment Master (page 16)
- Comprehension Check (page 17)

Science Background

Seamounts are underwater mountains that rise at least 1,000 meters above the ocean floor. They are formed by volcanic activity and are often the remains of old volcanoes.

Although each seamount is an individual structure, seamounts often form in groups or long chains. This is because seamounts are found near "hotspots" in the oceanic crust. Melted rock called "magma" bubbles up through a "hotspot." When a moving tectonic plate passes over the "hotspot," a chain of volcanoes rises in its wake.

Scientists estimate that there are more than 100,000 seamounts in the world's oceans. Yet less than one-tenth of a percent of those seamounts have ever been explored. But as more explorations take place, scientists have quickly learned that seamounts are more than underwater obstacles for submarines to avoid. They are also rich, diverse habitats that cover more area than any land-based habitat on Earth.

Seamounts have tall, steep sides. This causes ocean water to flow upward, pushing nutrients toward the surface. Some organisms attach to a seamount's side where they settle and grow. Others become trapped in the spinning water at the seamount's summit. While they can feast on the nutrients that also become trapped here, they are easy prey for larger ocean predators.

ENGAGE

Tap Prior Knowledge

Instruct students to think about the tallest mountain they've ever seen—either in real life or in a photograph. Now tell them to imagine that this mountain is located in the ocean. It sits on the ocean floor, well below the water's surface. Brainstorm ideas about what students might discover if they were able to explore this mountain.

EXPLORE

Preview the Lesson

Display pages 10-11 of the projectable magazine. Have students examine the diagram. **Ask:** *What part of this diagram can tell you the height of this seamount? (the meter marks) Why is the top meter mark located above the top of the seamount? (That mark shows the water's surface. The top of the seamount is 200 meters below the water's surface.) What else does this diagram tell you about seamounts? (It identifies zones and tells what lives in each one. It shows that the amount of light decreases the deeper you go in the water.)* Tell students that they'll learn more about seamounts and what lives near them as they read the article.

Set a Purpose and Read

Have students read the article to recognize where seamounts form, understand how seamounts create unique ocean ecosystems, and identify reasons why seamounts are one of the most common yet least explored ecosystems on the planet.

Mountains in the Sea

SCIENCE

EXPLAIN

Recognizing Where Seamounts Form

Display pages 12-13 of the projectable magazine. Zoom in on the map. Inform students that the gray ridges in the oceans show the edges of tectonic plates. Point out the red dot. **Say:** *This dot is not on one of those gray ridges. That's because seamounts like this one are often located on "hotspots" in the oceanic crust. "Hotspots" aren't on plate borders. They form where melted rock called "magma" bubbles up through the crust. This creates volcanoes.* Explain that seamounts are often the remains of old volcanoes. Display pages 10-11 of the projectable magazine. Tell students to look at the shape of the seamount in this diagram. Encourage students to compare the seamount's shape to that of an old volcano.

Understanding Seamount Ecosystems

Display pages 10-11 of the projectable magazine. Review the diagram to examine how a seamount's shape causes nutrients to rise, creating a unique ecosystem. Then point out the class that the meter marks in the diagram correspond with the layers of mountain life identified in the sidebar. Review the information and have students identify organisms that live in different zones of a seamount ecosystem. Give each student a copy of the **Content Assessment Master**. Instruct students to draw a picture of a seamount. Tell them to include arrows to show the movement of water and nutrients up the seamount's side. Then have them identify and describe each zone and list animals that live at each level of a seamount ecosystem.

Understanding the Mystery of Seamounts

Inform students that seamounts are common ecosystems, but they are one of the least-explored marine ecosystems on the planet. Encourage students to review the article in small groups. Challenge them to find reasons why it is so difficult to explore seamount ecosystems. (Possible responses: They're underwater; They're huge; They're in the middle of the ocean; They're found near "hotspots" in the oceanic crust.)

ELABORATE

Find Out More

Display pages 14-15 of the projectable magazine. Inform students that the three animals shown here live in seamount ecosystems. Divide the class into small groups. Instruct groups to conduct research to find photos of more seamount organisms. Challenge them to find photos of organisms that live in each layer of a seamount ecosystem.

Extend Your Thinking About Seamounts

As a class, review the final section of the article, "Seamount Security." Discuss how people's actions are damaging seamount ecosystems. Brainstorm ideas about how people can work together to help protect them.

EVALUATE

Have students record their answers to the assessment questions in their science notebooks or on a separate sheet of paper.

- *What causes seamounts to form?* (volcanic activity)
- *Why aren't there any plants at the bottom of a seamount?* (This is no sunlight there. They need sunlight to grow.)
- *How does a seamount's height change ocean currents?* (A seamount's slopes force water up its sides. Water moves faster around seamounts than in the open ocean.)

If you wish, have students complete the **Comprehension Check** to assess their knowledge of concepts mentioned in the article.

VOCABULARY ASSESSMENT: Mountains in the Sea

Use this organizer to examine each vocabulary word.

Write the definition.	What is the word?	Restate in your own words.
Draw a picture.		Use the term in a sentence.

Write the definition.	What is the word?	Restate in your own words.
Draw a picture.		Use the term in a sentence.

Write the definition.	What is the word?	Restate in your own words.
Draw a picture.		Use the term in a sentence.

LANGUAGE ARTS ASSESSMENT: Mountains in the Sea

Describe how seamounts form.

First,

Next,

Then,

Finally,

Complete each sentence. Write a "C" above each cause. Write an "E" above each effect.

If water hits a seamount's base, _____

If living things get trapped at the top of a seamount, _____

A seamount's height changes ocean currents because _____

Name _____

Date _____

CONTENT ASSESSMENT: Mountains in the Sea

Draw a seamount. Use arrows to show how nutrients rise to the surface. Then record information about the four zones in a seamount ecosystem.

	Zone Name	Description	What Lives There

COMPREHENSION CHECK: Mountains in the Sea

Read each question. Fill in the circle next to the correct answer or write your response on the lines.

1. What is a seamount?
Ⓐ an underwater mountain
Ⓑ an active volcano
Ⓒ an ocean current

2. Where do seamounts rise from?
Ⓐ the ocean surface
Ⓑ the ocean floor
Ⓒ the ocean water

3. How many zones are in a seamount ecosystem?
Ⓐ three
Ⓑ four
Ⓒ five

4. In which seamount zone do the most plants and animals live?
Ⓐ sunlight zone
Ⓑ twilight zone
Ⓒ midnight zone

5. Explain how nutrients from the ocean floor reach plants and animals on the surface.

Objectives

- Students will record, define, and sketch vocabulary words and draw a picture to show how the words are related.
- Students will recognize characteristics of writing in the first-person point of view.
- Students will write a first-person narrative about the article.

Resources

- Vocabulary Assessment Master (page 22)
- Language Arts Assessment Master (page 23)

Summary

- In the article "Signs and Symbols," National Geographic Emerging Explorer Genevieve von Petzinger reveals important findings from her extensive research on paintings and engravings in ice age caves in Europe.

BUILD VOCABULARY AND CONCEPTS

- engraving
- ice age
- symbol

Display the vocabulary words on a word wall or on the whiteboard. Say the words aloud and invite students to share what they know about each.

Give each student a copy of the **Vocabulary Assessment Master**. Instruct students to write each word and its definition on their papers. Then have students draw a picture to remind themselves of what each word means.

When students are finished drawing their interpretations of individual words, discuss with the class how the words could be related. Then challenge students to sketch a larger picture showing a potential connection between the three words. Instruct students to label each item in their drawings.

READ

Let students know that in this article they meet National Geographic Emerging Explorer Genevieve von Petzinger and learn about important findings from her extensive research on paintings and engravings in ice age caves in Europe.

Display pages 16-17 of the projectable magazine. Read aloud the headline and the introduction. Point out to students that the person featured in this article, Genevieve von Petzinger, is also the writer. As a class, discuss how this could affect what students read in the article.

Introduce the concept of first-person perspective.

Say: *When somebody writes about their own experiences, they may write in the first-person. This means that they are telling readers about events from their own point of view. This type of writing is easy to spot. Sentences contain the words I and we. The text is written so readers experience the event just as the writer did when it occurred.*

Give each student a copy of the **Language Arts Assessment Master**. Have students read the article on their own. After reading, tell them to draw one or two symbols from the diagram on page 23. Then tell them to imagine that they lived during the last ice age. Something just happened that caused them to write these symbols on a cave wall. Instruct students to write a first-person story about the incident. Have them include details that tell what the symbols mean and why they drew them on the cave wall.

LANGUAGE ARTS

TURN AND TALK

Have students turn and talk to discuss what they learned about Genevieve von Petzinger and her quest to understand the ancient signs and symbols on cave walls. **Ask:** *When were the signs and symbols von Petzinger studies created? (during the last ice age; up to 40,000 years ago) Why is it so hard to find some of the signs and symbols? (They are written on walls deep inside tight, muddy caves.) What did von Petzinger discover after exploring more than 350 different cave sites? (The same 32 symbols appear at each site.)* Encourage students to share other facts they learned as they read the article.

- **Recognizing First Person** Remind students that first-person is a type of writing in which the text is presented from the writer's point of view. Select a section of the article. Have students point out each use of the words *I* and *we*. Replace the pronouns with *he/she/they* or *him/her/them* to rewrite that section from a different perspective. Examine the results.

- **Writing from the First-Person Perspective** Point out to students that when people tell stories, they often use the word *I* to tell what they did. But when they write, particularly in published material like magazine articles, it's more common for them to use other pronouns like *he*, *she*, and *they*. **Say:** *That's because most of the time people are writing about other people's experiences. If anyone other than Genevieve von Petzinger had written this article, it would have been written that way, too.* Inform students that one benefit of writing from the first-person point of view is that it brings readers into the story. **Say:** *You aren't watching someone explore a narrow cave. You're in the cave with them.* Have students take out their **Language Arts Assessment Masters**. Instruct students to share their narratives in small groups. Tell them to examine how writing in first-person impacted how the writer wrote the story and how the listeners felt when they heard it.

WRITE AND ASSESS

You may want students to write about what they learned to assess understanding. Encourage students to reflect upon what they read and how it affected their ideas about the topic.

- *What is an ice age?*
- *What does von Petzinger think some of the signs mean? Do you think this makes sense? Why?*
- *What surprised you about what you read?*

Signs and Symbols

SOCIAL STUDIES

Objectives

- Students will understand what happens during an ice age.
- Students will understand how the author observes and records information about the past.

Resources

- Content Assessment Master (page 24)
- Comprehension Check (page 25)

Social Studies Background

As a young child, National Geographic Emerging Explorer Genevieve von Petzinger loved to dig things up. And like many children, she became obsessed with dinosaurs. It wasn't until her teen years that she realized her true passion. She wanted to learn about the people who lived thousands of years ago.

Now a paleoanthropologist, von Petzinger studies our human ancestors using fossils and other remains. Her primary focus is studying the geometric signs and symbols that are painted and engraved on cave walls.

Von Petzinger says she became intrigued with the signs and symbols because nobody else in her field was studying them. Everyone else was focused on the drawings of animals and people.

Over the past few years, von Petzinger has explored more than 350 ice age sites in Europe. Her work has taken her deep into caves, often crawling through tight passages. She has recorded her findings at each site and built a database to interpret the information. It revealed a startling fact: The signs and symbols were created over a 30,000-year time period, but there were only 32 symbols in all.

Now, the challenge is to interpret what the signs and symbols mean. Von Petzinger admits that may be an impossible task. But with the help of modern technology the study of things like constellations, lunar cycles, and ancient landscape features, she hopes to find out.

ENGAGE

Tap Prior Knowledge

Have each student take out a piece of paper. Then ask them to draw symbols that represent three things: a question; addition; and money. Compare students' responses. Are they all the same? {?, +, \$} Guide the class to understand that this likely happened because these are the symbols used to represent those concepts in our culture. As a class, discuss how people could learn to interpret symbols from a culture that ended 10,000 years ago.

EXPLORE

Preview the Lesson

Display pages 16-17 of the projectable magazine. Instruct students to examine the image. Poll the class to see how many students think the circled symbols have a meaning? Brainstorm ideas about what those meanings could be.

Set a Purpose and Read

Have students read the article in order to understand what happens during an ice age and understand how the author observes and records information about the past.

EXPLAIN

Understanding Ice Ages

Display page 19 of the projectable magazine. Zoom in on the sidebar about ice ages. Invite a volunteer to read the information aloud. **Ask:** *What happens during an ice age?* (Glaciers cover large parts of the world.) *How long can an ice age last?* (millions of years) *What happens when an ice age ends?* (The glaciers melt.) Remind students that glaciers are huge masses of ice that flow like very slow rivers across the land. As they move, they reshape the land beneath them. Brainstorm ideas about how the last ice age and the warm period that followed could have changed Earth's surface.

EXPLAIN

(continued)

Understanding How People Study the Past

Display page 18 of the projectable magazine. Zoom in on the blurb at the bottom of the page. Invite a volunteer to read it aloud. **Say:** *When we think about studying the past, fossils are one of the first things that come to mind. We can learn a lot from studying the remains of plants and animals that lived long ago. But fossils aren't the only things that can teach us about the past. Artifacts can do that, too. Artifacts are objects created by humans at different times in the past.* **Ask:** *What types of artifacts does Genevieve von Petzinger study? (signs and symbols) Where does she find them? (in caves)* **Say:** *The symbols that von Petzinger studies must have had a purpose. But we don't know what they mean today because there's nobody left to tell us.* Assign each student a partner and give each student a copy of the **Content Assessment Master**. Instruct students to draw eight symbols that have meaning today. Then have them write a short caption that tells people of the future what each one means.

ELABORATE

Find Out More

Remind students that the last ice age ended long ago. But according to the article, people who lived then left behind artifacts including tools, clothing, shelters, and art that was painted and engraved on cave walls. As a class, conduct research to learn more about these artifacts. Challenge students to identify explain what the artifacts tell them about ice age people and their culture.

Extend Your Thinking About Signs and Symbols

Remind students that nobody knows what the ancient signs and symbols on cave walls mean. The writer thinks some might have represented rivers or other landmarks on a map. Give students a moment to study the signs and symbols in the diagram on page 23 of their student magazines. Based on what they know of the last ice age, challenge the class to think of a reasonable meaning for each symbol.

EVALUATE

Have students record their answers to the assessment questions in their science notebooks or on a separate sheet of paper.

- *Does Genevieve von Petzinger know what the ice age signs and symbols mean? Why or why not? (No. There is no written explanation and there's nobody left to tell her what they mean.)*
- *What kinds of artifacts did people from the last ice age leave behind? (tools, clothing, shelters, and artwork painted and engraved on cave walls)*
- *How many caves has von Petzinger explored? How many different symbols has she found? (She's explored more than 350 sites. There are only 32 different symbols.)*

If you wish, have students complete the **Comprehension Check** to assess their knowledge of concepts mentioned in the article.

Name _____

Date _____

VOCABULARY ASSESSMENT : Signs and Symbols

Write each word and its definition. Draw a small picture to show what each word means. Draw a larger picture to show how the words could be related. Label each word in your sketch.


Word	Definition	Picture	Larger Picture	

Name _____

Date _____

LANGUAGE ARTS ASSESSMENT: Signs and Symbols

Pick one or more symbols from page 23 of the article. Draw a picture of each.



Imagine that you lived during the last ice age. Write about something that happened and caused you to draw the symbols on a cave wall. Tell what the symbols mean.

CONTENT ASSESSMENT: Signs and Symbols

Draw eight symbols that people use today. Write a short caption for each so people of the future know what the symbols mean.

COMPREHENSION CHECK: Signs and Symbols

Read each question. Fill in the circle next to the correct answer or write your response on the lines.

1. Where does Genevieve von Petzinger go to study our human ancestors?

- Ⓐ museums
- Ⓑ glaciers
- Ⓒ caves

2. Why type of artifact does she study?

- Ⓐ pictures of animals
- Ⓑ pictures of people
- Ⓒ signs and symbols

3. What happens during an ice age?

- Ⓐ Glaciers cover much of Earth.
- Ⓑ Glaciers melt around the world.
- Ⓒ Glaciers only form at Earth's poles.

4. Which of these statements is true?

- Ⓐ Ice age signs and symbols are some of the oldest art in the world.
- Ⓑ There are hundreds of different ice age signs and symbols.
- Ⓒ People know what ice age signs and symbols mean.

5. What is a symbol?

The Four That Roar

Assess Vocabulary, page 6

Students should record the vocabulary words from the Wordwise feature on page 9, make checkmarks to show how familiar they are with each word, and write definitions in their own words. Then they should record the definitions from the article.

adaptation: a behavior or body art that helps an animal survive

conservationist: a person who works to protect and manage Earth's natural resources and the wildlife that depends on those resources

poach: to illegally hunt an animal, usually to sell its meat, skin, or other body parts

Assess Language Arts, page 7

Details from the text and photos will vary. Students should note that the map tells where each group of big cats lives.

Assess Content, page 8

Students may identify differences in fur, hunting behaviors, or habitats. Similarities include: all four roar, are carnivores, and hunt for prey. All four also have shrinking habitats and problems with humans.

Possible response: Big cats are losing their habitat because people are taking over their land.

Potential problems: fewer wild animals to eat; conflicts with farmers when they eat their livestock; poachers

Potential solutions: paying farmers for lost livestock; putting livestock in pens; creating reserves; connecting pieces of habitat; photo safaris

Comprehension Check, page 9

1. C; 2. B; 3. A; 4. B; 5. Possible response: Travelers pay to see big cats up close. The money from tourists helps local people and makes the big cats worth protecting.

Mountains in the Sea

Assess Vocabulary, page 14

Students should record the words and definitions from the Wordwise feature on page 15.

biodiversity: the many different kinds of plants and animals on Earth or in a habitat or ecosystem

ecosystem: the plants, animals, and non-living things that make up an environment and affect each other

seamount: an underwater mountain formed by volcanic activity

Students should restate each definition in their own words. Sentences and drawings will vary but should accurately reflect the meaning of each word.

Assess Language Arts, page 15

Description: (Possible response) First, a volcano erupts and breaks through the seafloor. Next, the volcano spits out lava and builds up the seamount. Some seamounts break through the ocean's surface. Then, erosion begins. Wind and rain grind down a seamount above the ocean's surface. Ocean currents wear and tear below. Finally, the seamount begins to sink.

If water hits a seamount's base (C), it carries nutrients to the surface as it rises upward. (E) If living things get trapped at the top of a seamount (C), they become food for ocean predators. (E) A seamount's height changes ocean currents (E) because its slopes force water up its sides. (C)

Assess Content page, 16

Drawings should resemble the diagram on pages 10-11 of the article.

Sunlight Zone: Plenty of sunlight; plankton, jellyfish, sharks

Twilight Zone: not much light; swordfish, squid, cuttlefish

Midnight Zone: no sunlight; no plants, corals, squid, octopuses

Abyss: cold and completely dark; sea cucumber, basket star, sea spider

Comprehension Check, page 17

1. A; 2. B; 3. B; 4. A; 5. Ocean water hits the seamount's base and pushes upward. The water carries nutrients to the surface.

Trailblazer

ANSWER KEY

(continued)

Signs and Symbols

Assess Vocabulary, page 22

Students should record the words and definitions from the Wordwise feature on page 22.

engraving: the process of cutting or carving a design on a hard surface

ice age: any of several cold periods during which glaciers covered much of Earth

symbol: something that stands for or represents something else

Sketches should accurately reflect the meaning of each word and how the terms are connected. Students should label all three terms in the larger drawing. Evaluate each response for accuracy.

Assess Language Arts, page 23

Students should copy one or more symbols from the diagram on page 23 of the article. Stories should revolve around something that could have happened during the last ice age. Students should tell what happened, why they drew the symbols on the cave wall, and what each symbol means.

Assess Content, page 24

Students should draw symbols that have meaning in today's society, such as a plus sign for addition or quotation marks to indicate direct speech. Their captions should be short but make clear the meaning of each symbol

Comprehension Check, page 25

1. C; 2. C; 3. A; 4. A; 5. A symbol is something that stands for or represents something else.