

## In This Guide

This guide contains language arts and science or social studies lessons for articles in this issue of EXPLORER PATHFINDER.

## Explorer Magazine

EXPLORER classroom magazines are written for each grade, 2-5. Through great storytelling and stunning photographs, the magazines develop literacy skills and teach standards-based content aligned with the Common Core State Standards (CCSS), Next Generation Science Standards (NGSS), or National Council for the Social Studies (NCSS). The activity on the magazine's back cover is tailored to the NG Learning Framework. (see page 2)

EXPLORER magazines offer engaging reading opportunities for students with different ability levels in the same class. All articles have been measured using the Lexile® Framework for Reading. Articles in EXPLORER PATHFINDER will be within the 450-850L range.

For additional resources to extend your students' learning, visit EXPLORER's website, [natgeo.org/explorermag-resources](http://natgeo.org/explorermag-resources).

## Your Subscription Includes:

- Magazines
- Classroom Posters
- Projectable Magazine
- Teacher's Guide
- App (additional subscription required)

## INTRODUCTION

### BACKGROUND

Since 1888, the National Geographic Society has funded scientists and explorers and shared their findings with the world. To support educators who use our resources, we have created a Learning Framework, which lays out what we believe students should learn from their experiences with the Society.

### PURPOSE

The Learning Framework was designed to convey the Society's core beliefs and values. It is built around a set of attitudes, skills, and knowledge that embody the explorer mindset.

To determine the learning outcomes within the Learning Framework, we dug deep into national standards in key subject areas. We also sought advice from subject matter and child development experts, along with the combined expertise of NG instructional designers, researchers, and content developers. To learn more, go to: <https://www.nationalgeographic.org/education/learningframework/>.

### IMPLEMENTATION

Each article in this magazine has a knowledge-based link to the Learning Framework. Students will use the skills and attitudes as they do the activity on the back cover. The activity relates to the article "Frozen... Again!"

## MINDSET OF AN EXPLORER

### KEY FOCUS AREAS



#### Attitudes

*National Geographic kids are:*

**CURIIOUS** about how the world works, seeking out new and challenging experiences throughout their lives.

**RESPONSIBLE**, with concern for the welfare of other people, cultural resources, and the natural world. NG kids are respectful, considering multiple perspectives, and honoring others regardless of differences.

**EMPOWERED** to make a difference. NG kids act on curiosity, respect, and responsibility. They are adventurous and persist in the face of challenges.



#### Skills

*National Geographic kids can:*

**OBSERVE** and document the world around them and make sense of those observations.

**COMMUNICATE** experiences and ideas effectively through language and media. They are storytellers!

**COLLABORATE** with others to achieve goals.

**SOLVE PROBLEMS** by generating, evaluating, and implementing solutions after identifying alternatives, weighing trade-offs, and making well-reasoned decisions.



#### Knowledge

*National Geographic kids understand:*

**THE HUMAN JOURNEY** is all about where we have been, where we live now (and why), and where we are going.

**OUR CHANGING PLANET** encompasses all that coexists on our planet—interconnected through systems that generate and nurture each other.

**WILDLIFE AND WILD PLACES** inhabit our planet—from the butterflies in our backyards to the lions in Africa.

# Turned to Stone

## LANGUAGE ARTS 710L

### Standard Supported

- Interpret information presented visually, orally, or quantitatively (e.g., in charts, graphs, diagrams, time lines, animations, or interactive elements on web pages) and explain how the information contributes to an understanding of the text in which it appears. (CCSS.RI.4.7)

### Resources

- Vocabulary Assessment Master (page 7)
- Language Arts Assessment Master (page 8)

### Summary

- The article "Turned to Stone" relates the discovery of the best-preserved fossil of a nodosaur ever found and explains how the fossil formed.

## BUILD VOCABULARY AND CONCEPTS

- **fossil**
- **herbivore**
- **paleontologist**
- **seaway**
- **sediment**

Display the vocabulary words on a word wall or on a whiteboard. Inform students that when they read they will encounter words they don't know. Remind them that using context clues such as the sentences before or after an unknown word and visuals such as photographs or illustrations can help them figure out what an unfamiliar word means.

Give each student a copy of the **Vocabulary Assessment Master**. Instruct students to record each vocabulary word from the article. Have them scan the article to locate each bold word in the text.

Have students find and record text and visual clues in the article related to each vocabulary word. Then instruct each student to record his or her own idea about what each word means. Invite volunteers to read aloud the definitions from the Wordwise feature on page 7 of their student magazines. Have students record the definitions on their worksheets. Encourage them to compare the definitions they wrote with the definitions from the text.

## READ

Inform students that in this article they will read about the discovery of the best-preserved fossil of a nodosaur, a type of dinosaur, that has ever been found. They will also learn how the fossil formed.

Display pages 2-3 of the projectable magazine. **Say:** *When people read, they usually focus on the words. Photos can tell you a lot, too. Often, however, the best way to fully understand a subject is to combine what you read with what you see. For example, when I look at this photo, I see what looks like a big chunk of rock. The headline even tells me this is a stone. But there's something familiar about the shape of this stone. And the headline doesn't just say it's a stone. It says it turned to stone.* **Ask:** *What could this mean?* Encourage students to share their ideas.

Then point out to the class that the photo and headline aren't the only pieces of information on the page. Invite a volunteer to read aloud the deck. **Ask:** *What exactly is this stone? And what was it before it turned into a rock?* Encourage students to answer the questions.

Point out to students that they could have answered these questions after reading the entire article, but it wasn't necessary. The answers were right there in the deck. Many times, readers can get essential information from photos, captions, diagrams, and other elements in the text. That information can quickly answer some of the questions they have.

Give each student a copy of the **Language Arts Assessment Master**. Then have students read the article on their own. As they do, instruct them to write a question and answer that they were able to address using each source. Point out to students that they will need to access the website to examine the 3-D model featured on page 6.

# Turned to Stone

## LANGUAGE ARTS

### TURN AND TALK

Have students turn and talk to discuss what they learned about fossils. **Ask:** *What is a fossil?* (part of an ancient plant or animal, or its shape, that has been preserved in rock) *What kind of scientist studies fossils?* (paleontologist) *Why is this fossil special?* (It shows the animal, a nodosaur, almost as it would have looked in life.) Invite students to share what else they learned about fossils.

- **Strengthen Understanding** Inform students that combining what you already know with what you learn can help readers understand new words. **Say:** *Once you understand what a word means, it's easier to use it correctly in a sentence.* Challenge students to make accurate statements using each of the vocabulary words. Encourage them to use their **Vocabulary Assessment Masters** as a resource. Remind students to be original. They shouldn't restate sentences from the article. They should create new sentences of their own.

- **Interpreting Information** After reading the article, remind students that articles contain much more than main text. They often contain photos, diagrams, captions, and maps. This article even had a link to a 3-D model. All of these elements highlight important points in the text. Because of that, readers can often find answers to questions more quickly if they study the text elements on the page. Have students share their **Language Arts Assessment Masters** in small groups. Instruct students to compare the questions and answers they recorded for each source. Because a variety of questions and answers is likely, encourage students to revisit each source to verify the link between each question and answer and the cited source.

### 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 did ancient nodosaurs look like?*
- *How was this nodosaur fossil discovered?*
- *What surprised you about what you read?*

# Turned to Stone

## SCIENCE

### Standard Supported

- Local, regional, and global patterns of rock formations reveal changes over time due to Earth forces, such as earthquakes. The presence and location of certain fossil types indicate the order in which rock layers were formed. (NGSS.4-ESS1-1)

### Resources

- Content Assessment Master (page 9)
- Comprehension Check (page 10)

### Science Background

When paleontologists want to learn about the past, they study fossils. Fossils are the remains, or traces of remains, of ancient organisms that have been preserved in rock.

There are many different types of fossils. Bones, shells, feathers, and leaves can become fossils. So can footprints and animal poo. Sometimes, an entire organism is preserved because the animal got stuck in amber or was frozen in ice. Most often, just the bones and teeth are preserved.

That's why the fossil of a dinosaur that was discovered in western Canada in 2011 is so amazing. The fossil is the preserved remains of a nodosaur, a dinosaur that lived 110 million years ago. It is so well preserved that it looks like a rocky statue of the dinosaur. Each sandy brown scale on its back is outlined with a gray circle. Fossilized remnants of skin cover the bumpy armor plates on its skull.

According to paleontologists, this extreme level of fossilization was possible for one reason. When the dinosaur died, it was quickly buried under the sea. Minerals replaced its soft tissues before they could rot away. And unlike many fossils, this dinosaur's body wasn't squashed flat as layers of sediment built up over time. Instead it retained its life-like form, resulting in the best preserved fossil of a dinosaur that has ever been discovered.

### ENGAGE

#### Tap Prior Knowledge

Instruct students to close their eyes and imagine that they lived during the time of the dinosaurs. Invite volunteers to describe what they see. What does the land look like? What is the climate like? What kinds of plants and trees are growing? What kinds of dinosaurs do they see? Encourage students to give detailed descriptions of their visions.

### EXPLORE

#### Preview the Lesson

Display pages 2-3 of the projectable magazine. Invite volunteers to describe what they see. **Ask:** *If you found this lump of rock in the ground, would you think it could be the remains of a dinosaur? Why or why not?* Encourage students to share their opinions. Tell students that as they read the article they will learn more about this dinosaur and how it came to be preserved in this way.

#### Set a Purpose and Read

Have students read the article in order to learn what a nodosaur is and understand how the process of fossilization works.

### EXPLAIN

#### Recognizing the Nodosaur

Instruct students to examine the image of the fossil on pages 2-3 of their student magazines. Then display pages 4-5 of the projectable magazine.

**Say:** *The photo and illustration you see here show a nodosaur, a type of dinosaur that lived 110 million years ago.* Guide the class to recognize that the area outlined in white represents the recovered remains they see in the photo. **Ask:** *Based upon what you see and read here, what do scientists know about the nodosaur?* (Possible response: It had armor plating; Its long shoulder spikes may have scared off rivals or attracted mates; The bottom of its five-toed feet had textured pads, similar to birds and big lizards.) Divide the class into small groups. Instruct groups to scan the article for more details about the nodosaur. Invite them to share what they learned with the class. (Possible responses: It lived 110 million years ago; It was like a rhinoceros and weighed 1,360 kilograms (3,000 pounds) and stretched 5.5 meters (18 feet) long; It was a herbivore; It lived in a warm, humid climate.)

#### Understanding the Process of Fossilization

Display the Wordwise feature on page 7 of the projectable magazine. Highlight the word *fossil*. As a class, review what a fossil is. **Say:** *When people think of fossils, they often picture bones. But fossils can be anything from preserved footprints or petrified wood to an entire body frozen in ice.* Point out to the class that how a fossil forms determines what it looks like millions of years later. **Say:** *Most dinosaur fossils are only bones. This nodosaur is different. Because of how and where it died, it looks almost like it would have in real life.* Display pages 6-7 of the projectable magazine. Review the diagram as a class. Then give each student a copy of the **Content Assessment Master**. Instruct students to put events in the correct order to explain how the nodosaur became a fossil. Challenge them to answer questions about how the nodosaur was preserved in its lifelike form.

### ELABORATE

#### Find Out More

Remind students that there are many different types of fossils. Many dinosaur fossils are bones. The nodosaur fossil is unique because minerals replaced its tissues, preserving it in lifelike form. Divide the class into small groups. Instruct groups to identify other types of fossils. Challenge them to outline a chain of events that could lead to each type of fossil being formed. Invite groups to share and compare their results with the class.

#### Extend Your Thinking About Fossils

Remind students that the nodosaur fossil featured in the article was found in Canada. But paleontologists say its body was buried in a sea. Have students study the maps on page 5 of their student magazines to learn how that is possible. Then use information from the article to discuss how the climate where the nodosaur was found has changed over the past 110 million years.

### EVALUATE

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

- *What is a seaway?* (an inland waterway connected to a sea)
- *What role did a seaway play in the preservation of this nodosaur fossil?* (Long ago, there was a seaway in what is now central Canada. That is where the nodosaur was buried and preserved.)
- *Why does the nodosaur fossil look almost like the dinosaur did when it was alive?* (It was buried quickly so its body wasn't destroyed. Then minerals soaked into its tissues, preserving its shape.)

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

Name \_\_\_\_\_

Date \_\_\_\_\_

**VOCABULARY ASSESSMENT: Turned to Stone**

Record information from the article about each vocabulary word.

Word					
Text Clues					
Visual Clues					
What I Think the Word Means					
Definition					

**LANGUAGE ARTS ASSESSMENT: Turned to Stone**

Find each source in the article. Record a question you can ask and the answer you find using each source.

Source	Question	Answer
photo, pages 2-3		
illustration, pages 4-5		
maps, page 5		
3-D model, page 6		
timeline, pages 6-7		



**CONTENT ASSESSMENT: Turned to Stone**

Put these events in the correct order to show how the nodosaur became a fossil.

_____ Minerals soaked into the nodosaur's tissues.
_____ Sediment quickly covered the nodosaur's body.
_____ The nodosaur ended up dead in a river.
_____ Layers of sediment built up and hardened over the nodosaur.
_____ The nodosaur's body sank to the ocean floor.
_____ A flood swept the nodosaur's body out to sea.

Use information from the article to answer each question.

1. What happened because the nodosaur's body was buried so quickly?

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2. What happened because minerals soaked into the nodosaur's tissues?

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3. Why was only half of the nodosaur's preserved body recovered?

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**COMPREHENSION CHECK: Turned to Stone**

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

1. When did nodosaurs roam Earth?  
Ⓐ 10 million years ago  
Ⓑ 100 million years ago  
Ⓒ 110 million years ago
  
2. What covered the nodosaur's body?  
Ⓐ long spikes  
Ⓑ heavy armored scales  
Ⓒ textured pads
  
3. What happened because minerals soaked into the nodosaur's tissues?  
Ⓐ Its body rotted.  
Ⓑ Its body became compressed.  
Ⓒ Its body was preserved.
  
4. Which of these statements is true?  
Ⓐ The nodosaur was a herbivore.  
Ⓑ The nodosaur lived in a cold, harsh climate.  
Ⓒ The entire body of this nodosaur was recovered.
  
5. How was the nodosaur's body discovered? Why was it buried so deep underground?

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### Standard Supported

- Determine the meaning of general academic and domain-specific words or phrases in a text relevant to a grade 4 topic or subject area. (CCSS. RI.4.4)

### Resources

- Vocabulary Assessment Master (page 15)
- Language Arts Assessment Master (page 16)

### Summary

- The article "Mineral Mania" examines minerals, the building blocks of rocks, and explains how we rely heavily on them in our daily lives.

## BUILD VOCABULARY AND CONCEPTS

- **atom**
- **gem**
- **geologist**
- **mineral**
- **mixture**

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 15 of the projectable magazine. Have students record those definitions and compare them with the definitions they wrote.

## READ

Inform students that the purpose of this article is to examine minerals and learn how we rely on them in our daily lives.

Give each student a copy of the **Language Arts Assessment Master**. Tell students that they will use this worksheet to explore words in four different ways: writing definitions, identifying the part of speech, recording facts, and making connections between vocabulary words.

Display the Wordwise feature on page 15 of the projectable magazine. Highlight the word *atom*. Instruct students to write *atom* in the center box of one of their word diagrams. Then have them record its definition. Encourage students to scan the article to find the bold word *atom* in the text. (page 11, column 1) Highlight the word on the screen.

Model how to explore the word's meaning. **Say:** *According to the definition, an atom is the smallest particle of a substance that has all the properties of that substance. I know that a particle is a thing and a noun is a person, place, or thing. That means that the correct part of speech to list here is noun.* Instruct students to write *noun* in the "Part of Speech" section of their diagrams.

Invite a volunteer to read aloud the paragraph in which the word "atom" appears. Highlight the last sentence of the paragraph. **Say:** *This sentence tells us one thing about atoms: In a mineral, atoms must be arranged in a pattern. That is a fact.* Have students record the fact on their diagrams.

Have students read the article on their own. As they do, instruct them to record additional facts about atoms. Tell them to record information about the other vocabulary words as well. Then have them select one word from the article that isn't in the Wordwise feature and investigate that word, too. After reading the article, challenge students to write at least one way each vocabulary word is connected to the others.

### TURN AND TALK

Have students turn and talk to discuss what they learned about minerals. **Ask:** *What is a mineral?* (a natural, solid material that is not of plant or animal origin) *Why isn't plastic a mineral?* (Minerals occur naturally in Earth. Plastic doesn't.) *How does a mineral become a precious gem?* (They are shaped and polished by craftspeople.) Have students share other facts they learned about minerals.

- **Strengthen Understanding** Inform students that it is essential for readers to understand technical terms when studying science-related topics. Without that knowledge, it's very difficult to understand the text. **Say:** *Once you do understand what scientific terms mean, you follow along with the text. You can also use the words correctly in sentences of your own.* Challenge students to make accurate statements using each of the vocabulary words. Encourage them to use their **Vocabulary Assessment Masters** and their **Language Arts Assessment Masters** as resources. But remind them to be original. Students should not restate sentences from the article. They should create new sentences of their own.

### 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 it accurate to say that all gems are minerals but most minerals aren't precious gems?*
- *Why are minerals an incredible natural resource?*
- *What surprised you about what you read?*

### Standard Supported

- Ask questions that can be investigated and predict reasonable outcomes based on patterns such as cause and effect relationships. (NGSS.4-PS3-3)

### Resources

- Content Assessment Master (page 17)
- Comprehension Check (page 18)

### Science Background

What do a diamond and the graphite in pencil lead have in common? Both of these substances are minerals. Minerals are naturally occurring, inorganic solids. They are made of chemical elements and their atoms are arranged in a distinct pattern.

There are about 4,000 different minerals on Earth. And each mineral has a specific set of physical properties. Some of these properties include color, hardness, luster (shininess), magnetism, and solubility, or the ability to dissolve in another substance.

While some properties can be observed, others must be tested. The Mohs Hardness Scale, for example, is used to test hardness. This test contains 10 known minerals, which have been classified based on their hardness. If one of these minerals produces a scratch when scraped against an unknown mineral, it is harder than that substance. If not, it is softer.

People use minerals in a variety of ways. Some minerals, like iron and calcium, are in the foods we eat. They help our bodies grow. Other minerals are used to create a multitude of products that we use each day. For example, talc can be ground into a food powder. Gypsum is used to make drywall. Precious minerals like diamonds, rubies, and emeralds are cut and polished into jewelry. A mineral's properties determine what it is like and how it can be used in a product.

### ENGAGE

#### Tap Prior Knowledge

Display three similar objects, such as a baseball, a football, and a basketball. Encourage students to describe each one. Challenge them to identify one way each ball is like one of the others. Then have them point out key differences. Guide the class to understand that they are describing properties of the three balls.

### EXPLORE

#### Preview the Lesson

Display pages 10-11 of the projectable magazine. Have students examine the headline, deck, and images. **Say:** *Each of the items you see in this photo is a mineral. According to the deck, minerals can be fancy, familiar, shiny or dull.* **Ask:** *What other words could you use to describe the minerals you see here?* Invite students to share their ideas. If necessary, suggest words such as *hard, soft, slick, bumpy*, etc. Tell students they will learn more about minerals and how people use them as they read the article.

#### Set a Purpose and Read

Have students read the article in order to understand what minerals are, identify properties of minerals, and recognize how those properties allow people to use minerals in a variety of different ways.

### EXPLAIN

#### Understanding What a Mineral Is

Display the Wordwise feature on page 15 of the projectable magazine. Invite a volunteer to read aloud the definition of *mineral*. (a natural, solid material that is not of plant or animal origin) Then instruct students to read the first column of copy on page 11 of their student magazines. Review the five characteristics of all minerals. **Ask:** *Based on the information here, how could the article's definition be expanded to include all five characteristics of minerals?* (Possible response: a natural, solid material that is made of chemical elements, has atoms arranged in a pattern, and is not of plant or animal origin)

### EXPLAIN

(continued)

#### Identify Properties of Minerals

Display pages 8-9 of the projectable magazine. Zoom in on the purple minerals at the bottom of the photo. Instruct students to review the article's images in their student magazines. **Ask:** *Based on what you see, is this mineral most likely to be aragonite, apatite, or amethyst? (amethyst) Why? (It's shiny, purple, and smooth, just like amethyst. Aragonite and apatite look different.)* Inform students that what they just did was to identify a mineral based on its properties.

**Say:** *Properties are what you can observe with your senses. Color, texture, and shininess, which geologists call luster, are all properties of minerals. As a class, brainstorm a list of other properties that could be used to describe minerals. Encourage students to review the article for examples. (Possible responses: magnetic ability, acidity, hardness, ability to glow in the dark)*

#### Recognizing How People Use Minerals

Display pages 12-13 of the projectable magazine. Review the diagram on the Mohs scale. **Say:** *The Mohs scale classifies minerals based on their hardness. How hard a mineral is determines how it can be used. Talc, for example, is a very soft mineral. People use it to make talcum powder. But diamonds are very hard. That's why they are used in drill bits. Diamonds are hard enough to cut their way through almost anything.* Divide the class into small groups. Instruct students to review the article to see how people use other minerals. Then give each student a copy of the **Content Assessment Master**. Instruct students to draw a picture that includes four items people use that contain minerals. Have students circle each item in their drawings. Instruct them to identify each item and the mineral it contains. Then challenge students to identify properties of each mineral that make it a good choice to use in each product.

### ELABORATE

#### Find Out More

Remind students that gems are minerals that have been cut and polished by craftspeople. Gems are precious, valuable stones. And some, like the Delhi Purple Sapphire, are famous. Assign each student a partner. Instruct pairs to conduct research to learn about other famous gems. Encourage them to select one, find a photo, and write a brief narrative explaining why the gem is so famous. Invite students to share their discoveries with the class.

#### Extend Your Thinking About Minerals

Poll the class to see how many students were surprised by the sheer number of everyday products they use that come from minerals. Remind students that minerals are natural resources. They are not human-made. Discuss what would happen if people used the entire supply of a mineral. Brainstorm reasons why it's important to "reduce, reuse, and recycle" every day.

### EVALUATE

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

- *How does the Mohs scale classify minerals? (It classifies them by hardness. Any higher numbered mineral can scratch the mineral below it.)*
- *How does a mineral become a gem? (Crafts people shape and polish a mineral into a precious gem.)*
- *Why do people use quartz in watches and other electronics to measure time? (If squeezed, quartz vibrates, emitting tiny electrical pulses.)*

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

Name \_\_\_\_\_

Date \_\_\_\_\_

**VOCABULARY ASSESSMENT: Mineral Mania**

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:

**LANGUAGE ARTS ASSESSMENT: Mineral Mania**

Use this organizer to explore each vocabulary word from a scientific point of view.  
 Pick one more word from the article and investigate it, too.

Definition	Part of Speech	
Word		
Connections		Facts

Definition	Part of Speech	
Word		
Connections		Facts

Definition	Part of Speech	
Word		
Connections		Facts

Definition	Part of Speech	
Word		
Connections		Facts

Definition	Part of Speech	
Word		
Connections		Facts

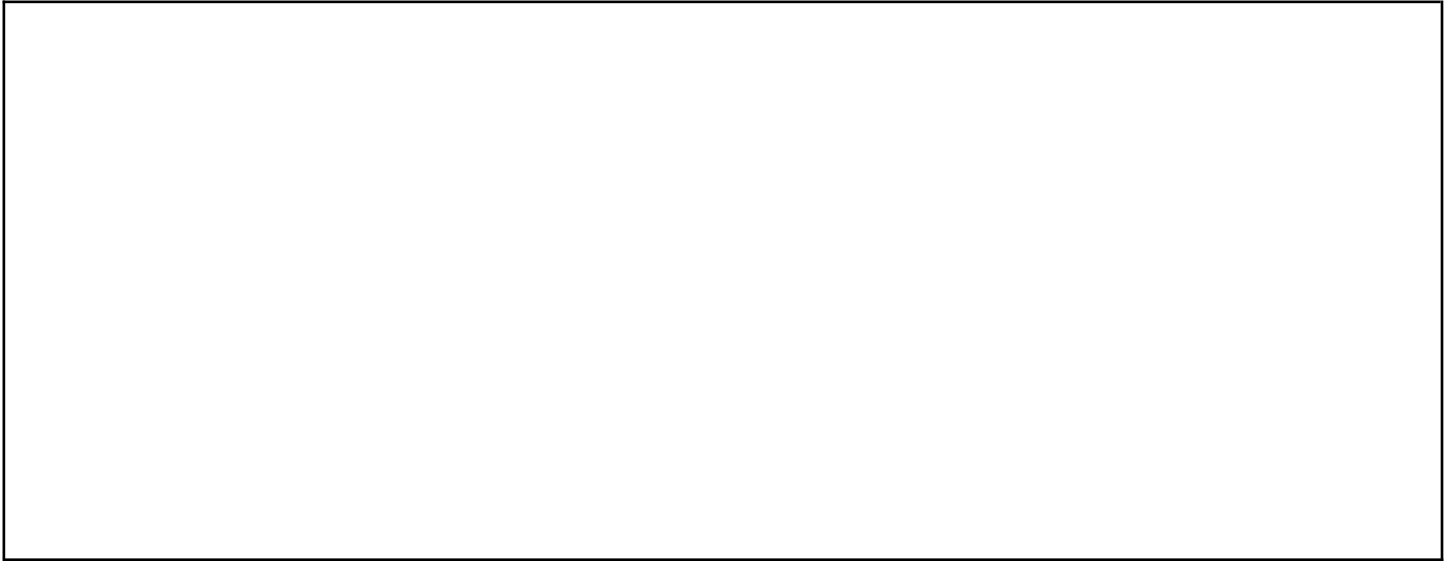
Definition	Part of Speech	
Word		
Connections		Facts

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**CONTENT ASSESSMENT: Mineral Mania**

Draw a picture that includes four items people use that contain minerals.  
Circle each item in your drawing.



Identify each item in your drawing. Tell what mineral it contains. Then identify properties of each mineral that make it a good choice to use in each product.

Item	Mineral	Properties

**COMPREHENSION CHECK: Mineral Mania**

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

- Which of these is a characteristic of all minerals?  
Ⓐ can be human-made  
Ⓑ comes from a living thing  
Ⓒ must be a solid
- What is a mineral that has been shaped and polished called?  
Ⓐ an atom  
Ⓑ a gem  
Ⓒ a mixture
- What does Mohs scale measure?  
Ⓐ luster  
Ⓑ weight  
Ⓒ hardness
- Which mineral can emit tiny electrical pulses?  
Ⓐ diamond  
Ⓑ quartz  
Ⓒ talc
- Name two everyday products that contain minerals. Identify the minerals they contain.

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### Standard Supported

- Determine the main idea of a text and explain how it is supported by key details; summarize the text. (CCSS.RI.4.2)
- Write narratives to develop real or imagined experiences or events using effective techniques, descriptive details, and clear event sequences. (CCSS.W.4.3)

### Resources

- Vocabulary Assessment Master (page 23)
- Language Arts Assessment Master (page 24)

### Summary

- The article "Frozen... Again!" introduces readers to Jade Hameister as the teen explorer tackles Greenland, the second leg of her Polar Hat Trick.

## BUILD VOCABULARY AND CONCEPTS

Display pages 22-23 of the projectable magazine. Point out to students that there is no Wordwise feature in this article. **Say:** *That doesn't mean, however, that there will be no unfamiliar words.*

Give each student a copy of the **Vocabulary Assessment Master**. As students read the article, instruct them to record each word they find difficult to understand. **Say:** *These may be words you've never seen before or they may be words you do know that are used in a new way.*

Tell students to circle three words on their lists. Have them predict and write a definition for each word. Next, instruct students to write a sentence using each word, based on the definitions they wrote. Then have students find each word in a dictionary and record its definition. If a word has multiple meanings, challenge students to use context clues in the article to select the correct definition. Have students write a new sentence based on the definition they found.

Invite volunteers to identify the words they defined and read aloud their before and after sentences. As a class, examine how investigating definitions helped students better understand each word.

## READ

Give students a few minutes to scan the article in their student magazines. **Then ask:** *What do you think this article is about? Why?* Encourage students to share their ideas.

Explain to students that what they just attempted to identify was the main idea or overall topic of the article. Everything in the article is connected to the main idea. Those ideas are supported by key details in the text.

Display pages 16-17 of the projectable magazine. **Say:** *When you read, the first thing you want to do is identify the main idea. In other words, you want to figure out what the article is about. Sometimes, that's easy. The photo might show you or the headline might tell you. Other times, it's not quite so obvious.* Highlight the article's headline. Invite students to share their ideas about what it might mean. Encourage students to offer any additional clues they see in the photo.

Then invite a volunteer to read aloud the deck. Give students a moment to scan the rest of the article. **Say:** *Now, we have some good clues. According to the deck, this article is about teenager Jade Hameister. She's already skied to the North Pole. Now, she's going to ski across the world's second largest polar ice cap. And according to the sidebar at the bottom of pages 18 and 19, that's not all. Jade also plans to ski across the South Pole at the end of this year. This article is about Jade tackling the second part of that goal.*

Give each student a copy of the **Language Arts Assessment Master**. Tell students to record the main idea of the article. (Teenager Jade Hameister skied across Greenland, the second leg of a Polar Hat Trick.) Then have students read the article on their own. As they read, instruct students to record key details that support the main idea of the article. Then have them write a one or two summary of the article.

# Frozen... Again!

## LANGUAGE ARTS

### TURN AND TALK

Have students turn and talk to discuss what they learned about Jade Hameister and her journey. **Ask:** *Who is helping Jade tackle her goals?* (her father and other polar expedition experts) *What treks make up the three parts of her goal?* (North Pole, Greenland, South Pole) *How will Jade be unique if she completes the Polar Hat Trick?* (She will be the youngest person to ever do this.) Encourage students to share other interesting facts they learned about Jade and her journey.

- **Support the Main Idea** Point out to students that it's easy to fill a page with details. The challenge for writers is to pick details that are important. The challenge for readers is to recognize important details when they see them. Have students share and compare their **Language Arts Assessment Masters** in small groups. Did they record the same details? If not, which important details did students miss? Are their summaries similar? If not, encourage students to review the article once again to ensure that all students have an accurate understanding of the text.

- **Write a Narrative** Inform students that a narrative is a story that tells about an experience or series of events. **Say:** *People can write narratives about their own lives or they can write about something that happened to someone else. This article is a narrative. It tells about Jade Hameister's journey across Greenland. But Jade didn't write this article. We know that because this article is not written from the first-person point of view.* Discuss what first-person is. If necessary, point out that Jade would have referred to herself as *I* if she had written the article. Instead, the writer calls her *she*. Have students take out their **Language Arts Assessment Masters**. Tell them to imagine that they are with Jade on her journey. Challenge them to write a detailed narrative describing their experience. Instruct them to write about the event from the first-person point of view.

### 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 a Polar Hat Trick?*
- *Where is Greenland and what is it like?*
- *What surprised you about what you read?*

# Frozen... Again!

## SCIENCE

### Standard Supported

- Research on a problem should be carried out before beginning to design a solution. Testing a solution involves investigating how well it performs under a range of likely conditions. (NGSS.3-5-ETS1-2)

### Resources

- Content Assessment Master (page 25)
- Comprehension Check (page 26)

### Science Background

Greenland, the world's largest island, is located between the Arctic Ocean and the North Atlantic Ocean. Two-thirds of its land mass lies within the Arctic Circle. And about 80 percent of the island is covered in ice.

In fact, Greenland has the second largest ice cap in the world. Its ice sheet covers about 1.8 million square kilometers (700,000 square miles) and is 3.2 kilometers (2 miles) thick at its center. Only Antarctica's ice sheet is bigger.

Crossing this frozen terrain is not easy. In addition to the expected—blizzards, icefalls, and below-freezing temperatures—there's the potential threat of polar bears. But that's just the sort of challenge 15-year-old explorer Jade Hameister anticipated as she and her team set out to cross Greenland in the summer of 2017.

Greenland was part two in Hameister's plan to score a Polar Hat Trick, or to conquer three extremely difficult polar treks. She tackled the first journey, skiing to the North Pole, the year before. The third leg, reaching the South Pole, is scheduled for December 2017.

Altogether, the three treks in Hameister's journey cover well over 1,000 kilometers (621 miles) of polar landscape. If she completes all three, she will be the youngest person ever to achieve this goal.

### ENGAGE

#### Tap Prior Knowledge

Instruct students to imagine that they just finished skiing 150 kilometers (93 miles) to the North Pole. In addition to skiing that distance, they had to pull a heavy sled, climb over tall piles of ice and make a raft to cross a patch of open sea. It was so cold that their hair froze. And it was hard to navigate because they were traveling across floating ice. After they finished, would they want to do something like this again? Why or why not?

### EXPLORE

#### Preview the Lesson

Display pages 16-17 of the projectable magazine. Invite a volunteer to read aloud the headline and deck. As a class, brainstorm a list of challenges people might face if they tried to ski across the world's second largest polar ice cap.

#### Set a Purpose and Read

Have students read the article in order to understand what the environment is like in Greenland and to recognize how prior knowledge allowed Jade Hameister and her team to overcome challenges as they made their way across Greenland.

### EXPLAIN

#### Understanding Greenland

Display pages 18-19 of the projectable magazine. Review with the class where Greenland is located on the map and the route Jade Hameister and her team took across the island during their expedition. **Say:** *Greenland is the world's second largest polar ice cap. At its center, the ice sheet is 3.2 kilometers (2 miles) thick.* Identify landmarks in your area that are that far apart to give students perspective on how thick the ice really is. Then draw students' attention to the photo of Jade's team carrying a sled. **Ask:** *If there's so much ice on Greenland, why are they carrying a sled across rocky terrain?* (Most of the coastal ice had melted because of a change in the climate.) Ask students to scan the article for more details about Greenland's environment.

#### Overcoming Challenges

Remind the class that part of Jade Hameister's plan when she and her team skied across Greenland was that they would do it all on their own. **Say:** *They didn't use vehicles, sled dogs, or helicopters to drop off supplies. So when they encountered obstacles, they had to figure out how to overcome them on their own.* Point out that sheer muscle power helped them overcome some obstacles, such as lack of ice and icefalls. But dealing with snow-caked skis and the polar bear threats required more creative solutions. Give each student a copy of the **Content Assessment Master**. Instruct students to explain why each of these issues was a problem and identify the team's solution. Challenge them to use what they know to explain why they think each solution worked.

### ELABORATE

#### Find Out More

Inform students that the Greenland Ice Sheet is the second largest polar ice cap in the world. It formed over thousands of years as layers of snow piled up into thick masses of ice. As the article points out, climate change is causing the Greenland ice cap to melt. Divide the class into small groups. Instruct groups to conduct research to learn more about how climate change is affecting Greenland's ice cap and what that means for the rest of the world.

#### Extend Your Thinking About Collaboration

Display the National Geographic Learning Framework feature on the back cover of the magazine. Challenge students to explain what collaboration is. (working together to achieve a goal) Discuss reasons why Jade Hameister had to collaborate with others to achieve her goals. Then divide the class into small groups. Encourage each group to identify a goal and write a plan explaining how they could achieve that goal. Make sure each group member has a role. Give students an opportunity to work together to achieve their goals.

### EVALUATE

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

- *What are the three treks in Jade Hameister's Polar Hat Trick?* (North Pole, Greenland, South Pole)
- *Why wasn't the team able to ski as soon as they reached Greenland's coast?* (There was no ice.) *Why?* (The coastal ice had melted because of climate change.)
- *Greenland is the second largest polar ice cap. What is the largest?* (Antarctica)

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

## VOCABULARY ASSESSMENT: Frozen... Again!

Record unfamiliar words from the article. Circle three words on the list.  
Use the organizer to investigate the meaning of those words.

Unfamiliar Words			
<b>Word</b>			
<b>Predicted Definition</b>			
<b>Sentence</b>			
<b>Dictionary Definition</b>			
<b>Sentence</b>			

**LANGUAGE ARTS ASSESSMENT: Frozen... Again!**

Record the main idea and key details from the article. Summarize the article.

<b>Main Idea</b>
<b>Key Details</b>
<b>Summary</b>

Imagine that you are with Jade Hameister as she skis across Greenland.  
Write a first-person narrative about the experience.

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Name \_\_\_\_\_

Date \_\_\_\_\_

**CONTENT ASSESSMENT: Frozen... Again!**

Use this organizer to answer questions about problems Jade and her team had as they crossed Greenland.

	Blizzard	Polar Bear Tracks
Why was it a problem?		
What was the team's solution?		
Why do you think their solution worked?		

**COMPREHENSION CHECK: Frozen... Again!**

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

1. What is Greenland?  
Ⓐ a continent  
Ⓑ an island  
Ⓒ a pole
  
2. What did Jade Hameister and her team do on the first day of their journey?  
Ⓐ walk and carry sleds  
Ⓑ ski through a blizzard  
Ⓒ climb icefalls
  
3. How much of Greenland is covered in ice?  
Ⓐ about 20 percent  
Ⓑ about 80 percent  
Ⓒ 100 percent
  
4. Which of these statements about Jade's journey is true?  
Ⓐ Jade saw a polar bear.  
Ⓑ The team's route crossed northern Greenland.  
Ⓒ The terrain on Greenland was unpredictable.
  
5. Identify a challenge Jade and her team faced. Explain how they overcame the obstacle.  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

# Understanding Maps

## NORTH AMERICA

### Standard Supported

- Use maps of different scales to describe the locations of cultural and environmental characteristics. (NCSS.D2.Geo.3.3-5)

### Resources

- Content Assessment Master (page 28)
- Comprehension Check (page 29)
- North America Physical Map poster (teacher's edition)
- North America Political Map poster (teacher's edition)

### Social Studies Background

Spatial thinking is an essential skill for students to develop as they learn about geography and Earth and environmental sciences. Developing spatial concepts takes time and practice. Recognizing that, each month Explorer magazine will introduce students to a new set of physical and political maps. Use the accompanying lessons to guide students as they learn to recognize spaces and places in the natural world.

## ENGAGE

### Tap Prior Knowledge

Ask students how many countries there are in North America. How many guessed three? (U.S., Canada, Mexico) Did anyone guess the correct answer? (23) Discuss where those countries could be.

## EXPLORE

### Preview the Lesson

Display the **North America Physical Map poster** and the **North America Political Map poster**. Cover the captions. Have students examine the photos. Discuss what each photo tells about North America.

### Set a Purpose and Read

Have students examine the posters in order to understand that physical and political maps can be used to describe the cultural and environmental characteristics of a location.

## EXPLAIN

### Explore the Physical Map

Display the **North America Physical Map poster**. Read aloud the text in the "Landforms" box at the top of the poster. Have students find the Appalachian and Rocky Mountains on the map. Challenge students to identify other mountain ranges and landforms in North America. Ask questions to help students make connections between items in the photos and the continent's physical features. **Ask:** *Why is it so hot in Death Valley?* (It's in a desert.) Invite students to share other connections they made about the physical characteristics of North America.

### Explore the Political Map

Display the **North America Political Map poster**. Point out the numerous countries in Central America and the Caribbean. Then invite volunteers to read aloud the captions below the photos and text in the boxes at the top of the poster. Discuss why each item is a political feature of North America.

## ELABORATE

### Find Out More

Explain to students that while physical and political features are different, they are often connected. For example, Greenland is the least densely populated country in the world (political) because most of it is covered by a giant ice sheet. (physical) Challenge students to identify more links between the physical and political features of North America.

### Extend Your Thinking About South America

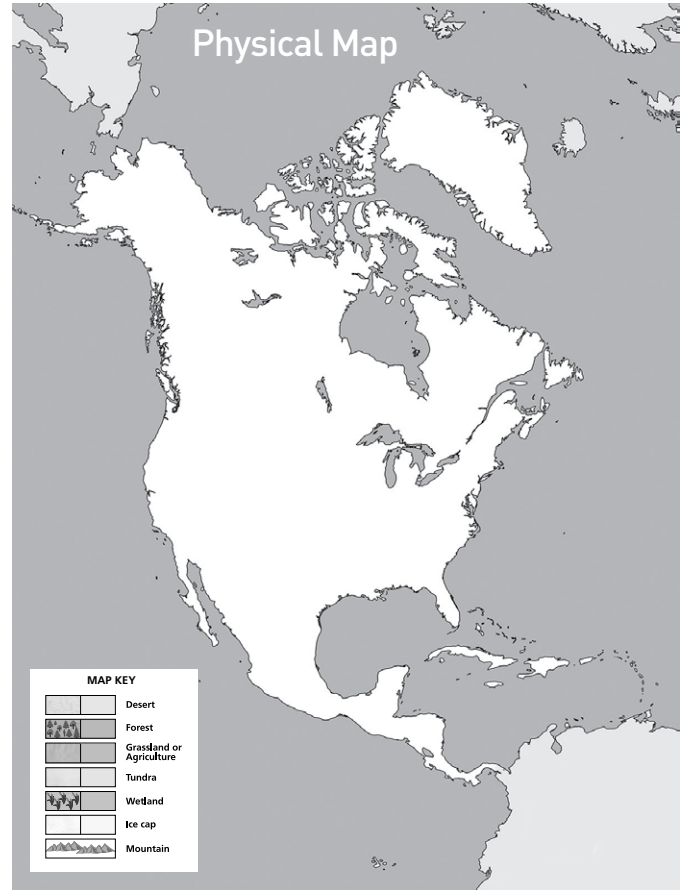
Give each student a copy of the **North America Map Content Assessment Master**. Have students create physical and political maps of North America. Then have them write three questions and answers about the continent's physical and political features.

## EVALUATE

Have students ask and answer questions about the physical and political maps. If you wish, have them complete the **Comprehension Check** to assess their knowledge of North American geography.

## CONTENT ASSESSMENT: North America Maps

Create political and physical maps of North America. Use symbols from the map keys.



Write questions and answers about the political and physical features of North America.

1. Q: \_\_\_\_\_

A: \_\_\_\_\_

2. Q: \_\_\_\_\_

A: \_\_\_\_\_

3. Q: \_\_\_\_\_

A: \_\_\_\_\_

**COMPREHENSION CHECK: North America Maps**

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

1. What is the largest country in North America?  
Ⓐ Canada  
Ⓑ United States  
Ⓒ Mexico
  
2. Which landform covers most of Greenland?  
Ⓐ mountains  
Ⓑ ice cap  
Ⓒ tundra
  
3. What is the capital city Canada?  
Ⓐ Montreal  
Ⓑ Toronto  
Ⓒ Ottawa
  
4. What body of water surrounds the smallest country in North America?  
Ⓐ Gulf of Mexico  
Ⓑ Caribbean Sea  
Ⓒ Atlantic Ocean

5. Write three facts about North America.

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### Turned to Stone

#### Assess Vocabulary, page 7

Students should record the words and definitions from the Wordwise feature on page 7.

**fossil:** part of an ancient plant or animal, or its shape, that has been preserved in rock

**herbivore:** an animal that eats plants

**paleontologist:** a scientist who studies fossils

**seaway:** an inland waterway connected to a sea

**sediment:** sand and stones deposited by water, wind, or a glacier

Text clues, visual clues, and what students think each word means may vary. Evaluate answers for accuracy.

#### Assess Language Arts, page 8

Students' questions and answers may vary but should be directly related to each source.

#### Assess Content, page 9

The correct order of events is: 5, 4, 1, 6, 3, 2.

**Question 1:** Because the nodosaur's body was buried so quickly, ocean animals weren't able to eat it and it didn't have a chance to rot.

**Question 2:** Because minerals soaked into the nodosaur's tissues, its shape was preserved.

**Question 3:** Only half of the nodosaur's preserved body was found because miners dug through the animal's back half before they saw it.

#### Comprehension Check, page 10

1. C; 2. B; 3. C; 4. A; 5. Possible response: A miner discovered it when he was carving his way through a mountain of dirt. It was buried so deeply because over millions of years layers of sediment built up and hardened over its body.

### Mineral Mania

#### Assess Vocabulary, page 15

Students should record the vocabulary words from the Wordwise feature on page 15, 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.

**atom:** the smallest particle of a substance that has all the properties of that substance

**gem:** a crystal of a mineral that has been cut and polished

**geologist:** a person who studies rocks and minerals

**mineral:** a natural, solid material that is not of plant or animal origin

**mixture:** two or more substances put together that do not form a new substance

#### Assess Language Arts, page 16

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

They should note the part of speech for each word, list facts, and make logical connections between vocabulary words. Students should investigate one word from the article that is not included in the Wordwise feature in this same way. All information should come from the article.

#### Assess Content, page 17

Students drawings should include four items mentioned in the article that are made from minerals. Each item should be circled in the drawing. Additional answers will vary depending on which items and minerals students include in their drawings.

#### Comprehension Check, page 18

1. C; 2. B; 3. C; 4. B; 5. Answers will vary.

(continued)

### Frozen... Again!

#### Assess Vocabulary, page 23

All unfamiliar words must appear in the article. Predicted definitions and sentences will vary. Students may use a printed or online dictionary to find each word's actual definition.

#### Assess Language Arts, page 24

Students should record the main idea of the article. (Jade Hameister is skiing across Greenland, the second part of a planned Polar Hat Trick.) Details and summaries will vary. Narratives should incorporate details from the text and be written from the first-person perspective.

#### Assess Content, page 25

**Blizzard:** (Problem) They could barely slide on their snow-caked skis; (Solution) They rubbed butter on their skis; (Explanation) This reduced friction between the skis and the ice so they could glide along on the snow.

**Polar Bear Tracks:** (Problem) The tracks meant that hungry polar bears were nearby. The bears could attack the explorers. (Solution) The team surrounded their tents with ropes and hung objects from the ropes. (Explanation) If the polar bears disturbed the ropes, the objects on the ropes would make noise. This would alert the explorers and possibly scare away the bears.

#### Comprehension Check, page 26

1. B; 2. A; 3. B; 4. C; 5: Answers will vary depending on which challenges students select.

### North America Map

#### Assess Content, page 28

Students should create physical and political maps, including map keys, like those on the posters. Questions and answers should be accurate and relate to the physical and political features of the continent.

#### Comprehension Check, page 29

1. A; 2. B; 3. C; 4: B; 5: Facts will vary but should come from the North America Physical or Political Map posters.