



The Earth Inside-Out, Part III

4

✔ **Lesson Objectives**

Core Content Objectives

Students will:

- ✓ Explain that much of our knowledge of the earth and its history is the result of the work of many scientists
- ✓ Describe volcanoes and geysers
- ✓ Describe how heat, pressure, and time cause many changes inside the earth

Language Arts Objectives

The following language arts objectives are addressed in this lesson. Objectives aligning with the Common Core State Standards are noted with the corresponding standard in parentheses. Refer to the Alignment Chart for additional standards addressed in all lessons in this domain.

Students will:

- ✓ Orally compare and contrast geysers and volcanoes (RI.1.9)
- ✓ Clarify information about “The Earth, Inside-Out, Part III,” by asking questions that begin with *what* (SL.1.2)
- ✓ Orally retell important facts and information from “The Earth Inside-Out, Part III” (SL.1.4)

Core Vocabulary

destructive, *adj.* Causing damage or ruin

Example: He was a very destructive puppy and often ate through shoes and slippers.

Variation(s): none

eruption, *n.* The act of exploding suddenly

Example: The volcanic eruption was very loud.

Variation(s): eruptions

geysers, *n.* Places on the earth where hot water and steam shoot up from inside the earth onto its surface

Example: Many people travel to see the geysers in Yellowstone National Park.

Variation(s): geyser

lava, *n.* Molten or liquid rock on the earth's surface

Example: After the lava rushed down the mountainside, it began to cool and harden.

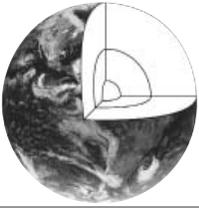
Variation(s): none

magma, *n.* Molten or liquid rock that is deep inside the mantle of the earth

Example: The hot magma slowly made its way to the crust of the earth.

Variation(s): none

<i>At a Glance</i>	Exercise	Materials	Minutes
<i>Introducing the Read-Aloud</i>	What Have We Already Learned?		10
	Purpose for Listening		
<i>Presenting the Read-Aloud</i>	The Earth Inside-Out, Part III	U.S. map, globe	15
<i>Discussing the Read-Aloud</i>	Comprehension Questions		10
	Word Work: Destructive		5
 Complete Remainder of the Lesson Later in the Day			
<i>Extensions</i>	Venn Diagram	Instructional Master 4B-1 (optional); chart paper, chalkboard, or whiteboard	20

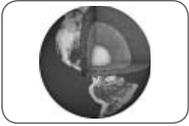


The Earth Inside-Out, Part III

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Introducing the Read-Aloud

10 minutes



What Have We Already Learned?

← Show image 3A-1: Diagram of the earth's layers

Using the diagram, have students name the layers of the earth: crust, mantle, outer core, and inner core. Remind students that heat causes hot rock to move around in the mantle, and sometimes rise up through the surface of the crust. This causes a volcano to form.



← Show image 4A-1: Volcano

Tell students that this is an image of a volcano. Have students describe what they see in the image.

Ask students to chant and clap three times the three important words that Gerry the Geologist said to remember when studying geology. (*Heat! Pressure! Time!*) Tell students that heat, pressure, and time are important because they cause changes to the earth that may result in volcanoes.

Purpose for Listening

Tell students that Gerry the Geologist will be telling them more about volcanoes in today's read-aloud. Tell them to listen carefully to learn more about some famous hot spots.



The Earth Inside-Out, Part III

← Show image 4A-2: Hawaii

Ah, Hawaii. I just love this place. The land is beautiful, the people are friendly, the weather is perfect, and the surfing is terrific. Personally, however, my favorite part of Hawaii is the volcanoes. If you like volcanoes—and all geologists do—then there is really no better place than Hawaii!

When most people think of volcanoes, they think of the top blowing off a mountain and **lava** flowing out everywhere.¹ Volcanic activity actually comes in many different forms, not all of which are as spectacular as a mountaintop **eruption**.²

1 Lava is molten or liquid rock that has come to the earth's surface.

2 or explosion



← Show image 4A-3: World map with Hawaii circled³

Hawaii is made up of eight major islands, seven of which are inhabited.⁴ The islands of Hawaii were formed by volcanic activity. In other words, if it weren't for volcanoes, Hawaii would not be there at all.

3 [Show students where Hawaii is located on a globe.]

4 *Inhabited* means that people live there.



← Show image 4A-4: Island volcano

Hawaii is one of the best known volcanic hot spots in the whole world. A hot spot is a place where there has been continuous volcanic activity for a long time.⁵ In Hawaii's case, the volcanic activity started underwater. In fact, most volcanic activity occurs underwater, deep down near the ocean floor. Down there, the crust is fairly thin, so it's easier for **magma** to seep up from the mantle.⁶

When a volcano erupts underwater, the lava that it releases cools very quickly. Over time—millions of years—this lava piles up.⁷ That is what happened in Hawaii. Over time, the lava continually erupting from the hot spot built up a pile that now reaches from the deep ocean floor all the way to the ocean surface, where it became new, dry land.⁸

5 Why do you think it's called a hot spot?

6 Magma is molten or liquid rock that is deep inside the earth in the mantle. What is it called once it comes to the surface of the earth? (lava)

7 Did you hear the word *time*? It takes a very long time for lava to pile up into mountains.

8 So, how did Hawaii form?



← **Show image 4A-5: Volcanoes National Park**

Hawaiian volcanoes erupt gradually, or little by little. The lava bubbles and gurgles and sputters rather than shooting up out of the earth all at once. There is still plenty of volcanic activity on some Hawaiian islands, which means the island chain is still growing.



← **Show image 4A-6: Mount St. Helens prior to eruption**

Now let's compare the Hawaiian volcano to another type of volcano—the kind where a mountaintop explodes! This volcano erupted in the state of Washington, which is on the West Coast of the United States.⁹ This is what Mount St. Helens looked like until the year 1980. Mount St. Helens proves that it is generally fairly easy to predict where a volcano will erupt; the hard part is figuring out when.

9 [Point out the state of Washington on a U.S. map.]



← **Show image 4A-7: Eruption of Mount St. Helens**

Mount St. Helens has erupted many times over the course of forty thousand or so years, and during this time the mountain's size and shape has changed. Magma is constantly building up within Mount St. Helens. Unlike the magma in the Hawaiian volcanoes, however, the magma in this area is much stickier than the magma in Hawaii, so it does not gurgle and sputter through little vents. Instead, the magma gets stuck, and incredible pressure builds up within the mountain. Eventually, the pressure becomes so intense that the mountain cannot hold it anymore, and . . . BOOM!¹⁰

10 Did you hear the word *pressure*? Pressure caused the volcano to erupt.

The eruption of Mount St. Helens was the most **destructive** volcanic eruption in U.S. history.¹¹ Hundreds of homes were destroyed and thousands of acres of forest were leveled when this mighty volcano erupted. In an instant, the top and one side of the mountain were literally blown away. Lava was not the main problem with Mount St. Helens. Rather, it was the immense amount of rock and ash that exploded into the air, as well as the landslides that followed as the mountain came crashing down into the valley below.

11 The word *destructive* means causing damage.



← **Show image 4A-8: Mount St. Helens today**

This is what Mount St. Helens looks like today. It's still tall enough to rise above the clouds, but if you compare this to the first picture you saw, you can see that it is not the same mountain it used to be. Mount St. Helens has erupted several more times after that day in 1980, and it still erupts occasionally to this day.



← **Show image 4A-9: Yellowstone Caldera**

Here is another place in the United States where there is lots of volcanic activity. This place is called Yellowstone National Park. Yellowstone is mostly in Wyoming, with parts of it extending into Idaho and Montana. Yellowstone National Park is home to many interesting and beautiful sites.¹² Like Hawaii, Yellowstone is situated on top of a hot spot, a place where there is lots of magma close to the surface. In Yellowstone, the magma has stayed underground and has not erupted onto the surface.

12 [Point out Wyoming, Idaho, and Montana on a U.S. map.]



← **Show image 4A-10: Hot springs and geysers**

Yellowstone is famous for its **geysers**. A geyser is a rare geologic event that occurs when water seeps down through cracks into the crust and meets up with hot rocks. When the water touches the hot rocks it turns into steam.¹³ As more water seeps in, more steam is created, and pressure begins to build. Eventually, all this heat and pressure forces the steam to find a way back out.¹⁴ As in other types of volcanic activity that you have learned about, this process is caused by the build-up and release of pressure underground.

13 Heat causes the liquid water to become a gas called steam, like the steam that comes out of a hot bowl of soup.

14 Did you hear the words *heat* and *pressure*? Heat and pressure cause geysers to erupt.

15 Lava spews out of a volcano. What spews out of a geyser?

The result is a geyser—steam and water spewing up out of the earth.¹⁵ These particular geysers are relatively small. They spurt and bubble all day long in water pools, or springs, which have a pretty, bluish-green color created by certain minerals that collect there.



16 Why do you think the geyser might be called Old Faithful? What does it mean to be reliable?

← **Show image 4A-11: Old Faithful**

This geyser has a name: it's called Old Faithful. The word *faithful* means trustworthy or reliable.¹⁶ Old Faithful got its name because you can count on the fact that it is going to erupt several times each day. It is not possible to predict exactly when it will erupt, but it typically blows its lid about every ninety minutes, give or take a few.

Old Faithful spews out steam and hot water for anywhere from one to five minutes. It can spew as much as 8,000 gallons of water up to 185 feet in the air. Every day during the summer, when the park is full of visitors, hundreds of people gather around to watch the world's most famous geyser.



← **Show image 4A-12: Volcano**

Although they come in many forms, shapes, and sizes, all volcanoes and geysers have two things in common: they are the earth's way of releasing heat and pressure from deep underground, and each one tells us a little more about the history of the earth. And one other thing: all volcanoes and geysers are extremely hot, so always keep a safe distance and admire them from afar!

Discussing the Read-Aloud

15 minutes

Comprehension Questions

10 minutes

If students have difficulty responding to questions, reread pertinent passages of the read-aloud and/or refer to specific images. If students give one-word answers and/or fail to use read-aloud or domain vocabulary in their responses, acknowledge correct responses by expanding students' responses using richer and more complex language. Ask students to answer in complete sentences by having them restate the question in their responses.

1. *Literal* What is a hot spot? (A hot spot is a place where there is lots of volcanic activity.)

2. *Inferential* How did volcanoes form the islands of Hawaii? (The islands were formed because of lava from volcanoes. The lava built up a pile over time that reaches from the ocean floor all the way to the ocean surface, where it became dry land.)
3. *Literal* In which layer of the earth does magma form? (Magma forms in the mantle.)
4. *Literal* Once magma erupts to the surface of the crust, what is it called? (Once magma erupts to the surface of the crust, it is called lava.)
5. *Literal* What is a geyser? (A geyser is a place where steam and water erupt from the earth.)
6. *Evaluative* What is Old Faithful? (*Old Faithful* is a well-known geyser in Yellowstone National Park.) Do you think *Old Faithful* is a good name for this geyser? Why or why not? (Answers may vary.)
7. *Evaluative* How is a volcano like a geyser? How are they different? (Volcanoes and geysers are both eruptions caused by heat and pressure inside the earth. They are different because a volcano is an eruption of lava, whereas a geyser is an eruption of steam and hot water.)
8. *Inferential* Why do scientists study volcanoes and geysers? (Scientists study volcanoes and geysers to learn more about the history of the earth and to help keep people safe.)

[Please continue to model the *Question? Pair Share* process for students, as necessary, and scaffold students in their use of the process.]

9. *Evaluative What? Pair Share:* Asking questions after a read-aloud is one way to see how much everyone has learned. Think of a question you can ask your neighbor about the read-aloud that starts with the word *what*. For example, you could ask, “What did you learn about in today’s read-aloud?” Turn to your neighbor and ask your *what* question. Listen to your neighbor’s response. Then your neighbor will ask a new *what* question, and you will get a chance to respond. I will call on several of you to share your questions with the class.

10. After hearing today’s read-aloud and questions and answers, do you have any remaining questions? [If time permits, you may wish to allow for individual, group, or class research of the text and/or other resources to answer these questions.]

Word Work: Destructive

5 minutes

1. In the read-aloud you heard, “The eruption of Mount St. Helens was the most *destructive* volcanic eruption in U.S. history.”
2. Say the word *destructive* with me.
3. *Destructive* means causing damage.
4. The destructive winds of the thunderstorm took some tiles off the roof of our school.
5. Have you observed events in nature that were destructive? Try to use the word *destructive* when you tell about it. [Ask two or three students. If necessary, guide and/or rephrase the students’ responses: “The _____ was very destructive.”]
6. What’s the word we’ve been talking about?

Use a *Making Choices* activity for follow-up. Directions: I will describe a situation. If I describe something that is destructive, you will say, “That’s destructive.” If I describe something that is not destructive, you will say, “That’s not destructive.”

1. The forest fire burned the homes of many animals. (That’s destructive.)
2. The winds of the hurricane blew a tree onto my neighbor’s car. (That’s destructive.)
3. We saw a beautiful rainbow after the thunderstorm. (That’s not destructive.)
4. The tornado blew the roof off the grocery store. (That’s destructive.)
5. The grass changed from brown to green after the spring rains. (That’s not destructive.)



Complete Remainder of the Lesson Later in the Day



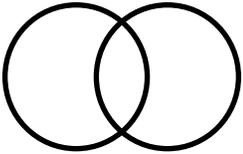
The Earth Inside-Out, Part III

4B

Extensions

20 minutes

Venn Diagram (Instructional Master 4B-1, optional)



Create a Venn diagram with two overlapping circles on chart paper, a chalkboard, or a whiteboard. Label the circles with simple drawings of a volcano and a geyser. Ask students to think about how volcanoes and geysers are alike. (Both have eruptions; both are caused by heat, pressure, and time; etc.) Record students' responses in the overlapping part of the circles. Tell students that you are going to write down what they say, but that they are not expected to be able to read what you write because they are still learning all the rules for decoding. Emphasize that you are writing what they say so that you don't forget. Tell them that you will read the words to them.

Next, ask students to think about volcanoes and how they are different from geysers. (Volcanoes erupt with lava; volcanoes create mountains; etc.) Record these responses in the "volcano" circle.

Next, ask students to think about geysers and how they are different from volcanoes. (Geysers erupt with steam and hot water; geysers may not be as destructive; etc.) Record these responses in the "geyser" circle. As students share, expand their responses using richer and more complex language, including, if possible, any read-aloud vocabulary.

Read the completed Venn diagram to the class.

➤ Above and Beyond: Instructional Master 4B-1 has been included if you have students who are ready to create the Venn diagram on their own, using the sound-spelling correspondences taught thus far.



Pausing Point

PP

Note to Teacher

You should pause here and spend one day reviewing, reinforcing, or extending the material taught thus far.

You may have students do any combination of the activities listed below, but it is highly recommended you use the Mid-Domain Student Performance Task Assessment to assess students' knowledge of the layers of the earth. The other activities may be done in any order. You may also choose to do an activity with the whole class or with a small group of students who would benefit from the particular activity.

Core Content Objectives Up to This Pausing Point

Students will:

- ✓ Identify geographical features of the earth's surface: oceans and continents
- ✓ Locate the North Pole, the South Pole, and the equator on a globe
- ✓ Describe the shape of the earth
- ✓ Explain that much of our knowledge of the earth and its history is the result of the work of many scientists
- ✓ Identify the layers of the earth: crust, mantle, and core (outer and inner)
- ✓ Describe the crust
- ✓ Describe the mantle and core inside the earth
- ✓ Describe volcanoes and geysers
- ✓ Describe how heat, pressure, and time cause many changes inside the earth

Student Performance Task Assessment

10 The Layers of the Earth (Instructional Master PP-1)

Directions: Label the layers of the earth. Color the crust brown, the mantle red, the outer core orange, and the inner core yellow.

Activities

The Earth's Surface

Materials: Globe

Use the globe to review the shape of the earth. Have students locate the continents, oceans, North Pole, South Pole, and equator.

Image Review

Show the Flip Book images from any read-aloud again, and have students retell the read-aloud using the images.

Image Card Review

Materials: Image Cards 1–6

In your hand, hold Image Cards 1–6 fanned out like a deck of cards: 1 (Heat), 2 (Pressure), 3 (Time), 4 (Earth's layers), 5 (Volcano), 6 (Geyser). Ask a student to choose a card but not show it to anyone else in the class. The student must then perform an action or give a clue about the picture s/he is holding. For example, for *pressure*, a student may use his/her hand to put pressure on a table. The rest of the class will guess what is being described. Proceed to another card when the correct answer has been given.

Domain-Related Trade Book or Student Choice

Materials: Trade book

Read a trade book to review a particular concept; refer to the books listed in the Introduction. You may also choose to have students select a read-aloud to be heard again.

Layers of the Earth: Peach

Materials: Peach

Bring in a fresh peach that has been cut into halves, and use it as a model of the layers of the earth. Point to the skin of the peach and ask students what it might represent. (*crust*) Point to the fleshy fruit and ask students what it might represent. (*mantle*) Point to the pit and ask students what it might represent. (*core*)

Note: Be sure to follow your school's policy regarding food distribution and allergies.

Layers of the Earth: Hardboiled Egg

Materials: Hardboiled egg

Bring in a hardboiled egg and use it as a model of the layers of the earth. Point to the eggshell and ask students what it might represent. (*crust*) Point to the white interior and ask students what it might represent. (*mantle*) Point to the yellow yolk and ask students what it might represent. (*core*)

Note: Be sure to follow your school's policy regarding food distribution and allergies.

You Were There: Volcanoes and Geysers

Materials: Chart paper, chalkboard, or whiteboard

Have students pretend that they witnessed the eruption of a volcano or geyser. Ask students to describe what they saw and heard. For example, for "volcano," students may talk about seeing the red-hot lava or ash in the air. They may talk about hearing the loud explosion. Consider also extending this activity by adding group or independent writing opportunities associated with the "You Were There" concept. For example, ask students to pretend they are newspaper reporters describing the eruption of a volcano or geyser. As reporters they might use as writing anchors the question words *who*, *what*, *when*, *where*, and *why*.

Note: You may wish to display the question words on chart paper, a chalkboard, or a whiteboard.

Key Vocabulary Brainstorming

Materials: Chart paper, chalkboard, or whiteboard

Give students a key domain concept or vocabulary word such as *mantle*. Have them brainstorm everything that comes to mind when they hear the word, such as *beneath the crust*, *very thick*, etc. Record their responses on chart paper, a chalkboard, or a whiteboard for reference.

Class Book: The History of the Earth

Materials: Drawing paper, drawing tools

Tell the class or a group of students that they are going to make a class book to help them remember what they have learned thus far in this domain. Have students brainstorm important information about features of the earth's surface, the layers of the earth, volcanoes, and geysers. Have each student choose one idea to draw a picture of, and then write a caption for, the picture. Bind the pages to make a book to put in the class library for students to read again and again. You may choose to add more pages upon completion of the entire domain before binding the book.

Heat, Pressure, and Time

Teach students a “signal” for each of the words *heat*, *pressure*, and *time*.

For *heat*, have students rub their hands together. Explain that rubbing their hands together quickly produces a little bit of heat.

For *pressure*, have students use their hands to press against their thighs. Ask the students if they can feel the pressure on their legs.

For *time*, have students say, “tick-tock, tick-tock” to pretend to be a clock.

Practice these “signals” until students are comfortable using them.

Tell students that you are going to say a word. They may then give any one of the three signals as long as they can explain how the two are connected. For example, if you say the word *volcano*, one student may give the signal for *heat* and say, “Heat makes the magma very hot.” A second student may give the signal for

pressure and say, “Pressure forces the magma to the surface of the earth.” A third student may give the signal for *time* and say, “It takes a long time for the magma to make its way to the surface of the earth.”

Letter to a Geologist

Materials: Writing paper, writing tools

As a class, brainstorm ideas and then write a letter to Gerry or a real geologist. The students may talk about the cool things that geologists do, or ask questions that they still have about the history of the earth.

You may also ask students to write individual letters if they are ready to do this activity on their own.

Internet Resources

There are many websites that give directions for building a model of a volcano.

Two excellent resources are the Geological Society of America at www.geosociety.org and the website www.geology.com.