DRAFT

For Review Purposes Only

These draft materials are intended to provide teachers with insight into the content and structure of the Listening & Learning strand of Core Knowledge Language Arts materials.

Revised materials produced specifically for NYSED, including materials from the Skills Strand, will be posted on this site in 2013. These new materials will include explicit alignment with Common Core State Standards, additional support for English Language Learners, and images and texts compliant with Creative Commons Licensing.

For more information on how to explore these materials, please see the Getting Started resources posted alongside these files on EngageNY.org.

Core Knowledge®

The Core Knowledge Language Arts Program

Listening & Learning Strand

Tell It Again! Read-Aloud Anthology

The History of the Earth

♦

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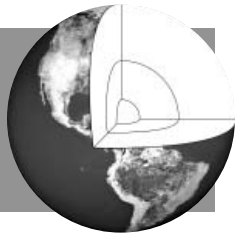
TABLE OF CONTENTS

The Core Knowledge Language Arts Program

The History of the Earth

Introduction to The History of the Earth



This introduction includes the necessary background information to be used in teaching The History of the Earth domain. The T*ell It Again! Read-Aloud Anthology* for The History of the Earth contains ten daily lessons, each of which is composed of two distinct parts, so that the lesson may be divided into smaller chunks of time and presented at different intervals during the day. The entire lesson will require a total of sixty minutes.

We have included three Pausing Points in this domain, after Lessons 4, 7, and 10. You may wish to pause and spend one to two days reviewing, reinforcing, or extending the material taught prior to the Pausing Point. You should spend no more than sixteen days total on this domain.

Along with this anthology, you will need:

- *Tell It Again! Media Disk* or the *Tell It Again! Flip Book* for The History of the Earth
- *Tell It Again! Image Cards* for The History of the Earth
- Tell It Again! Workbook for The History of the Earth

You will find the Instructional Objectives and Core Vocabulary for this domain below. The lessons that include Student Choice/ Domain-Related Trade Book Extensions, Image Cards, Parent Letters, Instructional Masters, and Assessments are also listed in the information below.

Why The History of the Earth Is Important

In this domain, students will learn about the geographical features of the earth's surface. They will also learn about the inside of the earth and characteristics of the various layers. Students will also learn about some of the earliest plants and animals that lived on the earth.

The first read-alouds in the domain focus on the geographical features of the earth's surface and the layers of the earth. Students will learn about the shape of the earth, the North and South Poles, and the equator. Students will also learn the names of the layers of the earth—the crust, the mantle, and the core—and characteristics of each layer. Students will also learn how occurrences such as volcanoes and geysers give information about the layers of the earth.

The middle read-alouds focus on minerals and rocks. Students will learn about the importance of rocks and minerals in their daily lives. They will also learn about the three types of rocks and characteristics of each type. Students will also learn how rocks and minerals are taken from the earth's crust to be used by people.

The final read-alouds focus on the history of living things on the earth. Students will learn that dinosaurs once roamed the earth, but are now extinct. Students will also learn about fossils and their importance in giving us knowledge about the history of living things on the earth.

Students will get a good introduction to the basics of geology and paleontology, and those in Core Knowledge schools will review and extend their learning about the earth in much greater depth in the fourth grade.

What Students Have Already Learned in Core Knowledge Language Arts During Kindergarten

The following kindergarten domains are particularly relevant to the read-alouds your students will hear in The History of the Earth:

- Plants
- Taking Care of the Earth

Listed below are the specific kindergarten content objectives that your students targeted in these domains. This background knowledge will greatly enhance your students' understanding of the read-alouds they are about to enjoy.

- Understand that there are many different kinds and sizes of plants
- Understand that different kinds of plants grow in different environments
- Describe what plants need to live and grow: food, water, air, and sunlight
- Identify the root, stem, branch, leaf, flower, fruit, and seed of a plant
- Understand that Earth is composed of land, water, and air
- Identify examples of land, water, and air from their own environments
- Understand that humans, plants, and animals depend on Earth's land, water, and air to live
- Understand that natural resources are things found in nature that are valuable and of great importance to people
- Identify key natural resources and describe how people use them

Instructional Objectives for The History of the Earth

The following chart contains all of the Core Content Objectives and Language Arts Objectives for this domain, broken down by lesson.

The History of the Earth Overview

Objectives	Lessons									
	1	2	3	4	5	6	7	8	9	10
Core Content										
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	✓									
Understand 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, core (outer and inner)		✓	✓							
Describe the crust		✓								
Describe each of the layers inside the earth			✓							
Describe volcanoes and geysers			✓	✓						
Identify common minerals in the earth					✓					
Explain how minerals are used by people					✓					
Identify the three types of rocks: metamorphic, sedimentary, and igneous						✓				
Describe how heat, pressure, and time cause many changes inside the earth			✓	✓		✓		✓		✓
Describe how rocks and minerals are taken from the earth							✓			
Describe fossils								✓	✓	
Explain how fossils provide information about the history of the earth								✓	✓	✓
Explain how we know about dinosaurs									✓	
Describe various dinosaurs									✓	
Explain the significance of the La Brea Tar Pits										✓

Objectives	Lessons									
	1	2	3	4	5	6	7	8	9	10
Language Arts										
Use agreed-upon rules for group discussions . . . (L.1.1)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Ask questions to clarify . . . classroom routines (L.1.2)	✓									
Carry on and participate in a conversation . . . (L.1.3)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Prior to listening to a read-aloud, identify (orally or in writing) what they know and have learned that may be related . . . (L.1.10)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Listen to and understand a variety of texts . . . (L.1.11)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Make predictions (orally or in writing) prior to and during a read-aloud . . . (L.1.12)									✓	
Use pictures accompanying the read-aloud to check and support understanding . . . (L.1.14)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Learn new words from read-alouds and discussions (L.1.15)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Answer questions (orally or in writing) requiring literal recall and understanding of the details and/or facts of a read-aloud . . . (L.1.17)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Ask questions to clarify information or the topic in a read-aloud (L.1.18)		✓		✓						
Answer questions (orally or in writing) that require making interpretations, judgments, or giving opinions . . . (L.1.20)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Compare and contrast (orally or in writing) similarities and differences within a single read-aloud or between two or more read-alouds (L.1.21)				✓						
Make personal connections (orally or in writing) . . . (L.1.22)	✓									
With assistance, create and interpret timelines . . . (L.1.23)								✓		✓
Draw pictures, dictate, or write simple sentences to represent details or information from a read-aloud (L.1.24)	✓								✓	
Evaluate and select read-alouds, books, or poems on the basis of personal choice for rereading (L.1.27)					✓					✓
Share writing with others (L.1.29)	✓		✓		✓			✓	✓	
Retell (orally or in writing) important facts and information from a read-aloud (L.1.36)			✓	✓			✓			
With assistance, categorize and organize facts and information . . . (L.1.38)		✓				✓				

Core Vocabulary for The History of the Earth

The following list contains all of the boldfaced words in The History of the Earth in the forms in which they appear in the text. The inclusion of the words on this list *does not* mean that students are expected to immediately be able to use all of these words on their own. However, through repeated exposure to these words, they should acquire a good understanding of most of these words and begin to use some of them in conversation.

Lesson 1

equator
geologist
geology
pressure
surface

Lesson 2

core
crust
eroded
layer
mantle

Lesson 3

disasters
liquid
molten
solid
volcano

Lesson 4

destructive
eruption
geysers
lava
magma

Lesson 5

gemstone
hobby
minerals
traces

Lesson 6

artifacts
igneous
metamorphic
sedimentary
sediments

Lesson 7

miners
mine
ore
quarries

Lesson 8

fossil
impression
paleontologist
preserved

Lesson 9

debris
excavating
extinct
fossilized
meteor
meteorite

Lesson 10

ice age
mammoth
petroleum
pits
tar

Student Choice and Domain-Related Trade Book Extensions

In the *Tell It Again! Read-Aloud Anthology* for The History of the Earth, Student Choice activities are suggested in the Pausing Points and in Lessons 5 and 10. Domain-Related Trade Book activities are suggested in the Pausing Points and in Lessons 5 and 9. A list of recommended titles is included at the end of this introduction, or you may select another title of your choice.

The History of the Earth Image Cards

There are fifteen Image Cards for The History of the Earth. The Image Cards may be used to help students make the connection between heat, time, and pressure and various geological events. Image Cards may also be used to review with students what they learned in the previous lesson. Image Cards may also be used to help students sequence the history of living things on the earth onto a timeline. In the *Tell It Again! Read-Aloud Anthology* for The History of the Earth, Image Cards are referenced in the Pausing Points and in Lessons 6, 8, 9, and 10.

Instructional Masters and Parent Take-Home Letters

Blackline Instructional Masters and Parent Take-Home Letters are included in the *Tell It Again! Workbook*.

In the *Tell It Again! Read-Aloud Anthology* for The History of the Earth, Instructional Masters are referenced in the Domain Assessment, and in Lessons 2, 3, 4, and 6. The Parent Letters are referenced in Lessons 1 and 5.

Assessments

In the *Tell It Again! Read-Aloud Anthology* for The History of the Earth, Instructional Masters DA-1, DA-2, and DA-3 are used for this purpose. Use the following Tens Conversion Chart to convert a raw score on each assessment into a Tens score.

Tens Conversion Chart

Number of Questions \ Number Correct	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
1	0	10																													
2	0	5	10																												
3	0	3	7	10																											
4	0	3	5	8	10																										
5	0	2	4	6	8	10																									
6	0	2	3	5	7	8	10																								
7	0	1	3	4	6	7	9	10																							
8	0	1	3	4	5	6	8	9	10																						
9	0	1	2	3	4	6	7	8	9	10																					
10	0	1	2	3	4	5	6	7	8	9	10																				
11	0	1	2	3	4	5	5	6	7	8	9	10																			
12	0	1	2	3	3	4	5	6	7	8	8	9	10																		
13	0	1	2	2	3	4	5	5	6	7	8	8	9	10																	
14	0	1	1	2	3	4	4	5	6	6	7	8	9	9	10																
15	0	1	1	2	3	3	4	5	5	6	7	7	8	9	9	10															
16	0	1	1	2	3	3	4	4	5	6	6	7	8	8	9	9	10														
17	0	1	1	2	2	3	4	4	5	5	6	6	7	8	8	9	9	10													
18	0	1	1	2	2	3	3	4	4	5	6	6	7	7	8	8	9	9	10												
19	0	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10											
20	0	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10										
21	0	0	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10									
22	0	0	1	1	2	2	3	3	4	4	5	5	5	6	6	7	7	8	8	9	9	10	10								
23	0	0	1	1	2	2	3	3	3	4	4	5	5	6	6	7	7	7	8	8	9	9	10	10							
24	0	0	1	1	2	2	3	3	3	4	4	5	5	5	6	6	7	7	8	8	8	9	9	10	10						
25	0	0	1	1	2	2	2	3	3	4	4	4	5	5	6	6	6	7	7	8	8	8	9	9	10	10					
26	0	0	1	1	2	2	2	3	3	3	4	4	5	5	5	6	6	7	7	7	8	8	8	9	9	10	10				
27	0	0	1	1	1	2	2	3	3	3	4	4	4	5	5	6	6	6	7	7	7	8	8	9	9	9	10	10			
28	0	0	1	1	1	2	2	3	3	3	4	4	4	5	5	5	6	6	6	7	7	8	8	8	9	9	9	10	10		
29	0	0	1	1	1	2	2	2	3	3	3	4	4	4	5	5	6	6	6	7	7	7	8	8	8	9	9	9	10	10	
30	0	0	1	1	1	2	2	2	3	3	3	4	4	4	5	5	5	6	6	6	7	7	7	8	8	8	9	9	9	10	10

Simply find the number of correct answers the student produced along the top of the chart, and locate the number of total questions on the worksheet or activity along the left side. Then find the cell where the column and the row converge. This indicates the Tens score. By using the *Tens Conversion Chart,* you can easily convert any raw score, from 0 to 30, into a Tens score. You may choose to use the Tens Recording Chart which is at the end of the appendix.

Recommended Trade Books for The History of the Earth

If you recommend that parents read aloud with their child each night, you may wish to suggest that they choose titles from this trade book list to reinforce the domain concepts.

1. *Digging Up Dinosaurs (Let's-Read-and-Find-Out Science 2),* by Aliki (HarperCollins, 1988) ISBN 0064450783
2. *Dinosaurs (Magic Tree House Guide),* by Will Osborne, Mary Pope Osborne, and Sal Murdocca (Random House Books for Young Readers, 2000) ISBN 0375802967
3. *Dinosaurs Before Dark (Magic Tree House, No. 1),* by Mary Pope Osborne and Sal Murdocca (Random House Books for Young Readers, 1992) ISBN 0679824111
4. *Earthquake in the Early Morning (Magic Tree House, No. 24),* by Mary Pope Osborne and Sal Murdocca (Random House Books for Young Readers, 2001) ISBN 067989070X
5. *Earthquakes (Let's-Read-and-Find-Out Science 2),* by Franklyn M. Branley and Megan Lloyd (HarperCollins, 2005) ISBN 0064451887
6. *Fossils Tell of Long Ago (Let's-Read-and-Find-Out Science 2),* by Aliki (HarperCollins, 1990) ISBN 0064450937
7. *Hill of Fire,* by Thomas P. Lewis and Joan Sandin (HarperCollins, 1983) ISBN 0064440400
8. *How to Dig a Hole to the Other Side of the Earth,* by Faith McNulty (HarperCollins, 1992) ISBN 0874992338
9. *If You Find a Rock,* by Peggy Christian and Barbara Hirsch Lember (Sandpiper, 2008) ISBN 0152063544
10. *Let's Go Rock Collecting (Let's-Read-and-Find-Out Science 2),* by Roma Gans and Holly Keller (HarperCollins, 1997) ISBN 0064451704
11. *The Magic School Bus in the Time of the Dinosaurs,* by Joanna Cole and Bruce Degan (Scholastic, 1995) ISBN 0590446894

12. *The Pebble in My Pocket: A History of Our Earth,* by Meredith Hooper and Christopher Coady (Viking Juvenile, 1996) ISBN 0670862592

13. *Rocks in His Head,* by Carol Otis Hurst and James Stevenson (HarperCollins, 2001) ISBN 0060294035

14. *Sabertooths and the Ice Age: A Nonfiction Companion to Sunset of the Sabertooth,* by Mary Pope Osborne, Natalie Pope Boyce, and Sal Murdocca (Random House Books for Young Readers, 2005) ISBN 0375823808

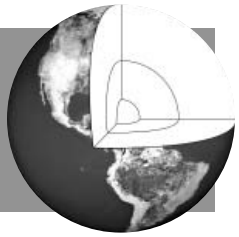
15. *Sunset of the Sabertooth (Magic Tree House, No. 7),* by Mary Pope Osborne and Sal Murdocca (Random House Books for Young Readers, 1996) ISBN 0679863737

16. *Vacation Under the Volcano (Magic Tree House, No. 13),* by Mary Pope Osborne and Sal Murdocca (Random House Books for Young Readers, 1998) ISBN 0679890505

17. *Volcanoes (Let's-Read-and-Find-Out Science 2),* by Franklyn M. Branley and Megan Lloyd (Collins, 2008) ISBN 0064451895

18. *Volcanoes: Mountains That Blow Their Tops,* by Nicholas Nirgiotis (Grosset and Dunlap, 1996) ISBN 0448411431

1 Our Home, Earth



Lesson Objectives

Core Content Objectives

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
- Understand that much of our knowledge of the earth and its history is the result of the work of many scientists

Language Arts Objectives

Students will:

- Use agreed-upon rules for group discussions, i.e., look at and listen to the speaker, raise hand to speak, take turns, say "excuse me" or "please," etc. (L.1.1)
- Ask questions to clarify directions, exercises, and/or classroom routines (L.1.2)
- Carry on and participate in a conversation over at least six turns, staying on topic, initiating comments or responding to a partner's comments, with either an adult or another child of the same age (L.1.3)
- Prior to listening to a read-aloud, identify (orally or in writing) what they know and have learned that may be related to the specific story or topic to be read aloud (L.1.10)
- Listen to and understand a variety of texts, including fictional stories, fairy tales, fables, historical narratives, informational text, nursery rhymes, and poems (L.1.11)

- Use pictures accompanying the read-aloud to check and support understanding of the read-aloud (L.1.14)
- Learn new words from read-alouds and discussions (L.1.15)
- Answer questions (orally or in writing) requiring literal recall and understanding of the details, and/or facts of a read-aloud, i.e., who, what, where, when, etc. (L.1.17)
- Answer questions that require making interpretations, judgments, or giving opinions about what is heard in a read-aloud, including answering "why" questions that require recognizing cause/effect relationships (L.1.20)
- Make personal connections (orally or in writing) to events or experiences in a read-aloud, and/or make connections among several read-alouds (L.1.22)
- Draw pictures, dictate, or write simple sentences to represent details or information from a read-aloud (L.1.24)
- Share writing with others (L.1.29)

Core Vocabulary

equator, *n.* The imaginary line around the center of the earth, halfway between the north and south poles
Example: They spent their summer vacation on an island near the equator.
Variation(s): none

geologist, *n.* Someone who studies the history of the earth
Example: A geologist spoke to the class about her studies in Hawaii.
Variation(s): geologists

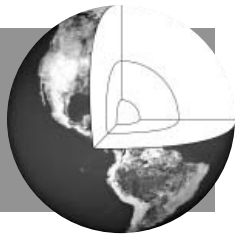
geology, *n.* The scientific study of the history of the earth
Example: In his spare time he read books to learn more about geology.
Variation(s): none

pressure, *n.* The continuous force of one object on another
Example: The nutcracker helped the girl create enough pressure to crack the walnut open.
Variation(s): pressures

surface, *n.* The topmost layer or outside of something
Example: She wiped the surface of the table with a wet cloth after dinner.
Variation(s): surfaces

At a Glance	Exercise	Materials	Minutes
Introducing the Read-Aloud	**Domain Introduction**		10
	What Do We Know?	globe	
	Purpose for Listening		
Presenting the Read-Aloud	**Our Home, Earth**	world map	15
Discussing the Read-Aloud	**Comprehension Questions**	globe	10
	Word Work: Surface		5
 **Complete Remainder of the Lesson Later in the Day**			
Extensions	**Drawing the Read-Aloud**	drawing paper, drawing tools	20
Take-Home Material	**Parent Letter**	Instructional Master 1B-1	

1A Our Home, Earth



Introducing the Read-Aloud

***10** minutes*

Domain Introduction

Tell the students that this domain is titled "The History of the Earth." Explain that scientists know that the earth has existed for billions of years. The history of the earth tells of the fascinating things that are or have been a part of the earth since its beginning. Tell the students that they will be learning about rocks and minerals, fossils and dinosaurs, volcanoes, and geysers.

What Do We Know?

Show students a globe, and remind them that it is a model of the earth. Ask students what they know about the earth. Use or have the students use the globe to point out what is being discussed. You may prompt discussion with the following questions:

- Is the earth covered by land or water or both?
- Do you know another name for the land of the earth?
- Can you name any of the continents?
- Do you know another name for the water of the earth?
- Can you name any of the oceans?

If you have already covered the *Astronomy* domain, remind students that they already learned about the solar system—our home in space—and that Earth, the planet on which we live, is just one of eight planets within the solar system. Tell students that in learning about the history of the earth, they are going to learn a lot more about our planet.

Purpose for Listening

Tell students that today they are going to meet an interesting scientist who knows a lot about the earth. Tell them to listen carefully to learn more about the earth.

Presenting the Read-Aloud — **15** *minutes*

Our Home, Earth

Show image 1A-1: Gerry the Geologist

Hello, kids! My name is Gerry and I'm a **geologist.** [1] What does a geologist do? Do I make things? Do I fix things? Do I sell things? [2]

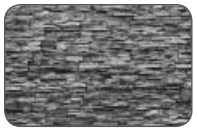
Well, let me tell you about geologists. A geologist is a type of scientist. A scientist studies and learns all about the world in which we live. Some scientists work to develop medicines; others study and learn about everything from tiny germs to distant stars. And some scientists study rocks.

Show image 1A-2: Collage of rocks

That's right: rocks! Stones. From pebbles to boulders, from a grain of sand to the highest mountain, rocks are everywhere, and I want to know all about them. You may not think too much about the rocks you see each day, but they're there.

Show image 1A-3: Jeweled crown

People used rocks to make the jewels on this crown.



Show image 1A-4: Rock wall

People use rocks to make buildings, walls, and streets.

Show image 1A-5: Marble statue of Abraham Lincoln

A sculptor carved a big rock to make this sculpture of Abraham Lincoln.

Show image 1A-6: Rocky mountain vista

Geologists use rocks to learn about the earth. In the ancient Greek language, the word *geo* means earth, and *-ology* means "the study of." So, geo-ology, or just **geology,** is the study of the earth. [3] The earth is mostly made of rock, so we geologists spend most of our time studying rocks. Many of the rocks we see on

1 Let's call him *Gerry the Geologist!*

2 What do you think a geologist does? (Pause for students to share ideas.)

3 Geology is the study of what?

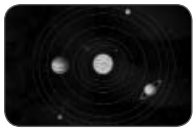
the **surface** of the earth, from mountains down to pebbles, are created by incredible forces at work deep inside the earth. [4] Thus, geologists study not only rocks, but also the forces at work inside the earth and on the earth's surface. We study the whole earth.

4 The surface of the earth is the outside of the earth. We walk and live on the surface of the earth. Have you ever wondered about what's inside the earth?

Show image 1A-7: Outer space

The history of the earth begins a little over four-and-a-half billion years ago. That's a long time—a very, very, very long time—ago. Before that, scientists believe the materials that now make up Earth were orbiting, or floating around, our newly formed sun as billions of little bits and pieces. Over millions of years, these floating bits and pieces gradually stuck together until they made up Earth, as well as its neighbor, the moon, and the other planets.

When it was newly formed, Earth was basically one big ball of hot, melted rocks. Over time, however, some of these materials cooled and hardened, allowing the planet Earth to become what it is today.



Show image 1A-8: Diagram of the solar system

Maybe you already know that Earth is a planet. Earth is one of eight major planets that orbits the sun. [5] Do you know the names of any of the other planets? [6] I do! Mercury, Venus, Mars, Jupiter, Saturn, Uranus, and Neptune.

Like the other planets in the solar system, Earth is trapped in the gravitational pull of the sun. This causes Earth to orbit or revolve around the sun. It takes one year, about 365 days, for Earth to complete an orbit around the sun. [7]

5 (Point to Earth on the diagram.) Earth is the third planet from the sun.

6 (Pause for responses if you have already covered the *Astronomy* domain, and point out each planet on the diagram.)

7 (Ask two students to demonstrate by having one student be a stationary sun and the other be the orbiting Earth.)

Show image 1A-9: World map

The earth's orbit around the sun is not the *only* way Earth moves in space, however.

This map shows the earth's north and south poles. [8] The north and south poles are imaginary points at the northernmost and southernmost parts of the earth. The axis of rotation is like an

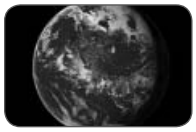
8 (Point to the north and south poles in the diagram.)

imaginary line or "stick" going right through the earth at the north and south poles. There is not really a "stick" running through the Earth around which it turns. The axis is an imaginary line around which Earth rotates. The earth rotates, or spins, in the same way that a globe spins—on its axis. It takes one day, or twenty-four hours, for Earth to make a complete rotation. [9]

9 (Use a globe to demonstrate rotation.) It takes one day for Earth to go all the way around its axis. As the Earth rotates, it also orbits the sun. (You may wish to demonstrate both motions of Earth using a student volunteer as the stationary sun.)

The map also shows the **equator,** an imaginary line around the middle of the earth. [10] The equator divides the earth into two equal halves. The area along the equator receives the most direct sunlight and is therefore generally the warmest area on the surface of the earth.

10 (Point to the equator on the map.)



Show image 1A-10: Earth from space

Earth is sphere-shaped, like a ball, and it is surrounded by a thick blanket of air, called an atmosphere, where clouds float around. Most of the earth's surface is covered with water in the form of the five oceans: [11] Pacific, Atlantic, Indian, Arctic, and Southern. And between these oceans there is land in the form of seven continents: North America, South America, Europe, Africa, Asia, Australia, and Antarctica.

11 (Point out the oceans and continents that are visible as you read.)

People haven't always known that the earth is round or that it rotates on its axis as well as orbits the sun; they haven't always known that there are five oceans and seven continents, or that most of the surface is covered in water. It has taken hundreds of years for scientists and explorers to develop all the knowledge about the earth that I just described in the last few minutes. But this barely begins to scratch the surface of what we now know about the history of the earth.

Show image 1A-11: Heat, pressure, and time

There are three important words you need to keep in mind whenever you are thinking about geology, which is the study of the earth. *Heat* is the first. You can feel heat from a flame or from the sun on a sunny day. Heat causes many changes to the earth.

The second word is ***pressure,*** like the force you use when you push on something. [12] Pressure, or the force of weight, also causes many changes to the earth.

12 (Pause for students to use their hands to put pressure on something.)

Time is the third important geology word to remember. To understand geology, you need to think about time in a whole new way. Forget about minutes, hours, and days. These amounts of time don't mean much in geology. Geologists think in terms of millions of years. That is how long it takes for pressure and heat to do what they do.

Show image 1A-12: Grand Canyon with view of Colorado River

The Grand Canyon, located in Arizona, provides a giant history book for geologists like me. It took millions of years for the rushing water in the river to carve through the rocks to make this canyon. No other place on earth allows me to see and study so many different layers of rock at the same time. The rock on the upper rim of the Grand Canyon is about 230 million years old, while the rock layers at the very bottom of the canyon were formed over two billion years ago. That rock is half as old as the earth itself!

Remember: Heat, pressure, and time are the main factors of geology. If you understand those three words, then you are ready to move ahead and learn many things about the history of the earth.

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 the students' responses using richer and more complex language. It is highly recommended that you ask students to answer in complete sentences by asking them to restate the question in their responses.

1. What does Gerry the Geologist study? (the earth, rocks)
2. How are rocks important to people? (They are used in jewelry making, in building, and in art. They tell us about the earth.) How have you ever used rocks? (Answers may vary.)
3. What is the shape of the earth? (sphere-shaped, round, like a ball)
4. What covers the surface of the earth? (seven continents and five oceans) Can you name any of the seven continents? (Africa, Antarctica, Asia, Australia, Europe, North America, South America) Can you name any of the five oceans? (Arctic, Atlantic, Indian, Pacific, Southern)
5. What are the North and South Poles? (the northernmost and southernmost points of the earth) Who can locate the North Pole on the globe? the South Pole?
6. What is the equator? (an imaginary line running around the outside of the earth at an equal distance from both poles) Who can locate the equator on the globe?
7. What are the three important words that Gerry said you need to remember when thinking about geology? (heat, pressure, and time)
8. When we talk about the history of the earth are we talking about a short time or a very long time? (a very long time, billions of years)

I am going to ask a question. I will give you a minute to think about the question, and then I will ask you to turn to your neighbor and discuss the question. Finally, I will call on several of you to share what you discussed with your partner.

9. *Think Pair Share:* Would you like to be a geologist like Gerry? Why or why not? (Answers may vary.)

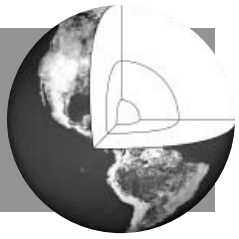
Word Work: Surface (5 minutes)

1. The read-aloud said, "Many of the rocks we see on the *surface* of the earth, from mountains down to pebbles, are created by incredible forces at work deep inside the earth."
2. Say the word *surface* with me.
3. The surface of something is the outside or top of it. [You may want to point out some surfaces in the classroom.]
4. I put the tea kettle on the surface of the stove.
5. Have you ever put something on the surface of an object? Try to use the word *surface* when you tell about it. (Ask two or three students. If necessary, guide and/or rephrase the students' responses: "I put _____ on the surface of . . .")
6. What's the word we've been talking about?

For follow-up name several objects in the classroom and have students identify what is on the surface of the object. (You may place specific items on the surfaces before doing this activity.) Remind the students to use the word *surface* in their responses. For example, you may ask, "What is on the surface of my desk?"

Complete Remainder of the Lesson Later in the Day

1B Our Home, Earth



Extensions

***20** minutes*

Drawing the Read-Aloud

Tell the students to think about the read-aloud they listened to earlier in the day: "Our Home, Earth." Tell them to draw three details that they remember about the read-aloud, allowing no more than six to eight minutes for the drawing. Explain that the drawing does not have to recreate a "scene" from the read-aloud or represent a coherent, integrated drawing of the read-aloud; the students may draw any three "things" that they remember about the read-aloud. Tell the students to also write about each of the three things. Some students may need to dictate to an adult what will be written. Others may write one word or a complete sentence.

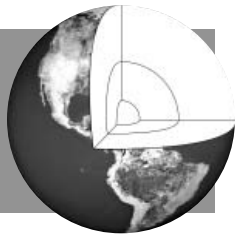
Say: Asking questions is one way to make sure everyone knows what to do. Think of a question you can ask your neighbor about the directions I have just given you. For example, you could ask, 'What should we do first?' Turn to your neighbor and ask your own question now. I will call on several of you to share your questions with the class.

Give the students the opportunity to share their drawings and writing with a partner or the entire class. As the students share, expand their responses using richer and more complex language, including, if possible, any read-aloud vocabulary.

Parent Letter

Send home Instructional Master 1B-1.

2 The Earth Inside-Out, Part I



Lesson Objectives

Core Content Objectives

Students will:

- Identify the layers of the earth: crust, mantle, core (outer and inner)
- Describe the crust
- Understand that much of our knowledge of the earth and its history is the result of the work of many scientists

Language Arts Objectives

Students will:

- Use agreed-upon rules for group discussions, i.e., look at and listen to the speaker, raise hand to speak, take turns, say "excuse me" or "please," etc. (L.1.1)
- Carry on and participate in a conversation over at least six turns, staying on topic, initiating comments or responding to a partner's comments, with either an adult or another child of the same age (L.1.3)
- Prior to listening to a read-aloud, identify (orally or in writing) what they know and have learned that may be related to the specific story or topic to be read aloud (L.1.10)
- Listen to and understand a variety of texts, including fictional stories, fairy tales, fables, historical narratives, informational text, nursery rhymes, and poems (L.1.11)
- Use pictures accompanying the read-aloud to check and support understanding of the read-aloud (L.1.14)

- Learn new words from read-alouds and discussions (L.1.15)
- Answer questions (orally or in writing) requiring literal recall and understanding of the details, and/or facts of a read-aloud, i.e., who, what, where, when, etc. (L.1.17)
- Ask questions to clarify information or the topic in a read-aloud (L.1.18)
- Answer questions that require making interpretations, judgments, or giving opinions about what is heard in a read-aloud, including answering "why" questions that require recognizing cause/effect relationships (L.1.20)
- With assistance, categorize and organize facts and information within a given domain (L.1.38)

Core Vocabulary

core, *n.* The center of the earth
Example: Today it is impossible to journey to the earth's core.
Variation(s): none

crust, *n.* The hard, thick, outer covering of the earth
Example: The workers drilled a few inches into the earth's crust.
Variation(s): none

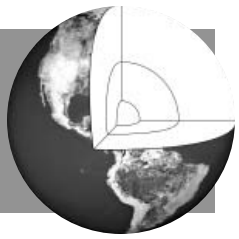
eroded, *v.* Worn away
Example: The writing on the Sphinx had been eroded by the wind and sand.
Variation(s): erode, erodes, eroding

layer, *n.* A single thickness of something
Example: The baker added a thin layer of chocolate to the cake.
Variation(s): layers

mantle, *n.* The layer of the earth between the crust and the core
Example: The mantle is the layer beneath the earth's crust.
Variation(s): none

At a Glance	Exercise	Materials	Minutes
Introducing the Read-Aloud	**What Have We Already Learned?**	globe	10
	Purpose for Listening		
Presenting the Read-Aloud	**The Earth Inside-Out, Part I**		15
Discussing the Read-Aloud	**Comprehension Questions**		10
	Word Work: Layer		5
 **Complete Remainder of the Lesson Later in the Day**			
Extensions	**Three-Column Chart: Earth's Crust**	Instructional Master 2B-1 (optional) chart paper	20

2A The Earth Inside-Out, Part I



Introducing the Read-Aloud

***10** minutes*

What Have We Already Learned?

Ask the students to share what they learned from the previous read-aloud about the surface of the earth. You may want to use a globe to point out features being discussed. You may prompt discussion with the following questions:

- What covers the surface of the earth? (rocks, land, water, continents, oceans)
- What do we call the northernmost point of the earth? (North Pole)
- What do we call the southernmost point of the earth? (South Pole)
- What do we call the imaginary line that runs around the outside of the earth at equal distances from both poles? (equator)
- What are the three important words that Gerry the Geologist said you need to remember when thinking about geology? (heat, pressure, and time)

As the students share, expand their responses using richer and more complex language, including, if possible, any read-aloud vocabulary.

Purpose for Listening

Tell the students that they have been talking about the surface of the earth. Ask students if they remember what the surface of something is. Explain that today they are going to learn about the inside of the earth. Tell them to listen carefully to find out what the inside of the earth is like.

Presenting the Read-Aloud — *15 minutes*

The Earth Inside-Out, Part I

Show image 2A-1: Gerry digging

Hello! Gerry the Geologist here again.[1] I woke up this morning and started digging this hole. Each time I push my shovel into the earth, I bring up a load of dirt, and I've noticed that each load of dirt has a few rocks in it. But these little rocks are not the reason I am digging this hole today. I am digging to teach you about the outer **layer** of the earth.[2]

1 What does Gerry study if he is a geologist?

2 The earth has layers—sort of like a sheet and blanket are different layers on a bed.

Show image 2A-2: Topsoil and clay

Beneath your backyard, the sidewalk, the school—actually, beneath most every place people live—there is dirt, or soil. In many places, if you dig down far enough, you will notice that there are layers of different types of soil. Each layer has a different color, hardness, and chemical makeup; in other words, each layer is made of different things.

The thickness of the soil varies depending on where you live. In some places, the soil is several feet thick.[3] In other places it is just a few inches, and in some places there is no soil at all. The soil is rich and dark near the surface here, but a couple of feet into my hole, I noticed a dramatic change in the soil color: It went from dark brown to bright red. At this point I have reached a layer of reddish clay. It's getting a little harder to dig now, so I'll have to use my pickax.

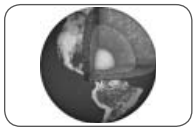
3 (Show the depths of "several feet" and then "a few inches" with your hands as you continue reading.)

Show image 2A-3: Topsoil, clay, and bedrock

Clank! My pick just hit something really hard. It may just be another little rock, but it felt a little different. The farther down I go, the harder the soil becomes. Pretty soon, I will hit bedrock—a solid layer of hard rock that I won't be able to dig through with my shovel.

I dug this hole to show you that there are different layers of soil and rock beneath your feet. The farther you go into the earth, the more things change. The soil on top is fairly easy to dig into with a shovel, but deeper layers are harder to dig because the dirt down there has been compacted—or squished—by the weight or pressure of the dirt above it. [4]

4 Remember *pressure* is one of the three words Gerry said we should remember. Pressure is one reason deeper layers of soil are harder to dig.



Show image 2A-4: Diagram of the layers of the Earth

This diagram shows you what the inside of the earth would look like if you could cut out a big chunk of it. The **crust** is the outermost layer of the earth, represented here by a thin brown line. [5] I have been digging into the very outermost portion of the crust today.

5 Point to each layer in the diagram as you read about it.

Most of the earth is rock, and most of that rock is beneath the crust in the other three layers: the **mantle** (red), the outer **core** (orange), and the inner core (yellow). The distance from the surface, where you and I live, all the way to the middle of the inner core is nearly four thousand miles. This is one thick planet! But compared to the other layers, the crust on which you live is pretty thin. The thickness of the earth's crust is between three and twenty miles, depending on where you are on earth. [6]

6 Three miles would be about the distance from here to ____; twenty miles would be about the distance from here to ____.

Show image 2A-5: Earth's crust

I will teach you more about the mantle and core next time. For now, let's focus on the thinnest layer: the crust. You and I live on the earth's crust. More specifically, we live on the surface, or outermost edge of the crust.

Remember, the earth's surface is covered by oceans and continents. The earth's crust tends to be thinner beneath the oceans and thicker beneath the continents. Everything alive on earth lives in, on, or above the crust. For example, you and your dog live on the crust. Worms and moles, on the other hand, live underground, or in the crust. Birds fly in the air above the crust, and fish swim in the water that is flowing on the crust.

Show image 2A-6: Layers in the crust

The crust is where geologists like me look to learn about the history of the earth. In the crust, we find different layers of rock, which teach us about different periods of time in the earth's history.

Show image 2A-7: Grand Canyon

Geologists search the crust for clues about the history of the earth. If you know what to look for, then the clues are usually not hard to find. I already introduced you to this place, called the Grand Canyon. Here, the geology of the earth's crust sits like an open book waiting to be read. Layer upon layer of history tells the geologist when this place was covered with a cool ocean and when it was not.

Show image 2A-8: Arches National Park

Geological or earth changes can do all sorts of tricky things to the rocks on the earth's crust. These formations in Arches National Park, in the state of Utah, show what thousands of years of wind, rain, and ice can do to this type of stone.

Show image 2A-9: Uluru

Some rocks are mysterious. This is called Uluru, or Ayers Rock. It is the only tall thing in an otherwise flat, barren grassland in the middle of Australia. Geologists have figured out that this is a remnant left over from a time when the entire surface there was covered in this type of rock.[7] Eventually, all the other rock **eroded** away due to wind and rain, but for some reason this one mound of rock remained.[8]

7 A remnant is something left over or remaining.

8 All the other rock was worn away by wind and rain.

Show image 2A-10: Cave

Different places tell different stories. Not all interesting rocks are above ground. This photo was taken down in a cave, which is a passage or chamber underground. A cave is basically an area in the earth's crust that has been hollowed out for one reason or another, usually as a result of underground water flowing in

and dissolving the rock over millions of years. Caves are really amazing, but they're no place for people who are afraid of the dark or tight spaces!

Show image 2A-11: Dinosaur bones

Geology isn't just about rocks; it is about finding clues as to what the surface of the earth used to look like and what types of plants and animals used to live here. The rocks are full of clues, and so are things called "fossils," including the bones of ancient forms of life that have been dead and gone for millions of years. You will be able to find the clues if you understand how and why certain rocks ended up where they are. Don't worry, I have a friend who will on another day, teach you all about how things like these dinosaur bones became fossils and what they can tell us about life on earth thousands of years ago.

Show image 2A-12: Gerry with shovel looking at hole he dug

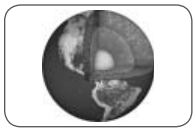
People usually do not think too much about what is happening underground, deep below our feet, but the fact is that what happens deep underground has everything to do with what we see in the world around us. You are only beginning to scratch the crust of the tremendously fascinating subject of geology. Next time we will take a closer look at what's happening in those other layers. I'd better go ahead and fill in this hole now. See you next time!

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 the students' responses using richer and more complex language. It is highly recommended that you ask students to answer in complete sentences by asking them to restate the question in their responses.

1. How would you describe the inside of the earth? (There are layers; there is a lot of rock; etc.)



Show image 2A-4: Diagram of the layers of the Earth

2. [Point to each layer as you ask each question.] What is the name of the outermost layer? (crust) What is the name of the next layer? (mantle) What is the name of the next layer? (outer core) What is the name of the innermost layer? (inner core)
3. Was Gerry digging in the crust, mantle, or core? (the crust)
4. On which layer of the earth do we live? (the crust)
5. What kinds of things are found in the crust of the earth? (soil, rocks, small animals, fossils, etc.)
6. Which layer do geologists study to learn about the history of the earth? (the crust)
7. How is the crust of the earth like the crust of a piece of bread? (It is the outermost layer.)
8. *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.

Word Work: Layer (5 minutes)

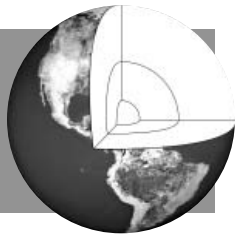
1. The read-aloud said, "I am digging to teach you about the outer *layer* of the earth."
2. Say the word *layer* with me.
3. A layer is a single thickness of a material covering a surface.
4. I spread a layer of peanut butter on the slice of bread.
5. Have you ever eaten food that had more than one layer? Have you ever worn more than one layer of clothing? Try to use the word *layer* when you tell about it. (Ask two or three students. If necessary, guide and/or rephrase the students' responses: "I wore a layer of _____ and a layer of _____.")
6. What's the word we've been talking about?

Use a *Making Choices* activity for follow-up. Directions: I will describe two different layers of something. You will decide which layer you prefer. Be sure to use the word *layer* in your answer. (Answers may vary for all.)

1. Would you rather have a layer of mustard or a layer of ketchup on a sandwich?
2. Would you rather walk barefoot on a layer of rocks or a layer of grass?
3. Would you rather wear one layer or several layers of clothing?
4. Would you rather the ground be covered with a layer of snow or a layer of leaves?
5. Would you rather try to dig through a layer of soil or a layer of rock?

Complete Remainder of the Lesson Later in the Day

2B The Earth Inside-Out, Part I



Extensions

***20** minutes*

Three-Column Chart: Earth's Crust (Instructional Master 2B-1, optional)

On a large piece of chart paper, create a chart similar to the one below:

above the crust	on the crust	in the crust

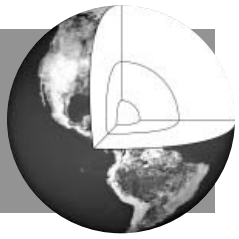
Ask the students to think about what they learned from the read-aloud about the crust of the earth. Have students brainstorm things that they heard about in the read-aloud or have observed above the crust. You may wish to reread the applicable part of the read-aloud. Record students' responses on the chart paper. Tell the 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.

Follow the same procedures for filling in "on the crust" and "in the crust."

Once the chart has been completed, read it to the class.

An optional instructional master has been included if you have students who are ready to fill in the chart on their own.

3 The Earth Inside-Out, Part II



Lesson Objectives

Core Content Objectives

Students will:

- Identify the layers of the earth: crust, mantle, core (outer and inner)
- Describe the mantle and core inside the earth
- Describe volcanoes
- Describe how heat, pressure, and time cause many changes inside the earth
- Understand that much of our knowledge of the earth and its history is the result of the work of many scientists

Language Arts Objectives

Students will:

- Use agreed-upon rules for group discussions, i.e., look at and listen to the speaker, raise hand to speak, take turns, say "excuse me" or "please," etc. (L.1.1)
- Carry on and participate in a conversation over at least six turns, staying on topic, initiating comments or responding to a partner's comments, with either an adult or another child of the same age (L.1.3)
- Prior to listening to a read-aloud, identify (orally or in writing) what they know and have learned that may be related to the specific story or topic to be read aloud (L.1.10)
- Listen to and understand a variety of texts, including fictional stories, fairy tales, fables, historical narratives, informational text, nursery rhymes, and poems (L.1.11)

- Use pictures accompanying the read-aloud to check and support understanding of the read-aloud (L.1.14)
- Learn new words from read-alouds and discussions (L.1.15)
- Answer questions (orally or in writing) requiring literal recall and understanding of the details, and/or facts of a read-aloud, i.e., who, what, where, when, etc. (L.1.17)
- Answer questions that require making interpretations, judgments, or giving opinions about what is heard in a read-aloud, including answering "why" questions that require recognizing cause/effect relationships (L.1.20)
- Share writing with others (L.1.29)
- Retell (orally or in writing) important facts and information from a read-aloud (L.1.36)

Core Vocabulary

disasters, *n.* Events that cause much destruction
Example: Technology has made it easier for scientists to predict natural disasters such as earthquakes.
Variation(s): disaster

liquid, *adj.* Moving or flowing freely
Example: There is liquid rock deep inside the earth.
Variation(s): none

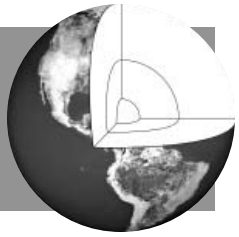
molten, *adj.* Made liquid by heat
Example: It takes very high temperatures to melt metals into molten forms.
Variation(s): none

solid, *adj.* Keeps its shape
Example: They put the jello in the refrigerator so that it would become solid.
Variation(s): none

volcano, *n.* A mountain formed by the ejection of lava, gasses, and ash from an opening in the earth's crust
Example: In order to study the volcano, the scientists had to climb from the bottom to the very top.
Variation(s): volcanoes

At a Glance	Exercise	Materials	Minutes
Introducing the Read-Aloud	**What Have We Already Learned?**	globe or map	10
	Essential Background Information or Terms		
	Purpose for Listening		
Presenting the Read-Aloud	**The Earth Inside-Out, Part II**		15
Discussing the Read-Aloud	**Comprehension Questions**		10
	Word Work: Solid		5
Complete Remainder of the Lesson Later in the Day			
Extensions	**The Layers of the Earth**	Instructional Master 3B-1	20

3A The Earth Inside-Out, Part II



Introducing the Read-Aloud

***10** minutes*

What Have We Already Learned?

Start off the review with a globe or map activity. Tell students that you will point out different features on the earth and students have to guess what you are pointing out on the earth's surface. You may wish to point out the following features:

- Each of the seven continents
- Each of the five oceans
- North Pole
- South Pole
- equator

Then, ask students if they remember the three factors that cause many changes to the earth and are important when studying geology? (heat, pressure, and time)

Ask the class to then name the layers of the earth: crust, mantle, and core. (You may want to show image 2A-4 again.) Have students share what they learned about the crust of the earth. Talk about what is on and in the crust. As the students share, expand their responses using richer and more complex language, including, if possible, any read-aloud vocabulary.

Essential Background Information or Terms

Explain to the students that all things on Earth can be described as being solid, liquid, or gaseous. Explain that if something is solid, it keeps its shape unless the conditions change. Give an example such as, "If I pick up a book and hand it to you, it will look the same; it will keep its shape. The book is solid."

Explain that if something is liquid, it can be poured. It doesn't keep its shape. Explain that the oceans are liquid. Give another example, such as, "If I put orange juice in my hand and then give it to you, it's probably going to move around. It's not going to keep its shape." (You may want to demonstrate this for the class.) Explain that a liquid takes the shape of the container it's in because the container keeps it together, unlike a solid which maintains its shape.

Explain that if something is gaseous, it is often hard to see. Explain that the air around us is not solid because it doesn't keep its shape, and it is not liquid because it cannot be poured; it is gaseous.

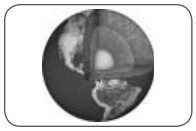
Explain that heat can cause something that is solid to melt and become liquid. It can also cause something that is liquid to become gaseous. Give examples, such as, "If I put a piece of solid butter in a pan and heat it up, it will melt into a liquid." "If I heat a little bit of liquid like water in a pan, it will disappear and turn into a gas." Explain that cooling can cause the opposite to happen; cooling causes something gaseous to become liquid, and something liquid to become solid.

Explain to the students that in today's read-aloud they will hear about parts of the earth that are solid and other parts that are liquid.

Purpose for Listening

Tell the students to listen carefully to find out more from Gerry the Geologist about the mantle and core of the earth and about parts inside the earth that are solid and other parts that are liquid.

Presenting the Read-Aloud **15** *minutes*



The Earth Inside-Out, Part II

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

Today, we are going to pretend that we can journey deep, deep into the earth, all the way to the very center nearly four thousand miles from where you are sitting right now.

The first stop is the layer beneath the crust, which is called the mantle. The mantle is a whopping 1,800 miles thick and contains most of the earth's rock. Since most of the earth is made of rock, that means that most of the earth is contained within the mantle.

The closer to the crust, the cooler and harder the mantle tends to be. But as you go deeper, closer to the core, the mantle gets hotter and its makeup becomes soft and gooey. High heat causes the materials in the mantle to get mushy, so things move around quite a bit, but in most places it is still **solid** rather than **liquid.** [2]

The mantle surrounds the core, or center, of the earth. The core has two parts: the inner core and the outer core. The inner core is a solid metal ball. [3] The outer core is also metal, but it is not solid—it is made up of melted, or **molten,** metal. [4] So, deep down inside the earth—thousands of miles beneath your feet—there is a giant sea of red-hot, molten metal surrounding a solid metal ball.

Scientists believe that the very center of the earth—the inner core—is actually hotter than the surface of the sun, which is a blazing 10,000 °F! So, the inner core is much hotter than the outer core. It may seem strange, therefore, that the outer core of the earth is molten metal, yet the inner core—at the very center of the earth where it is hottest—is a solid ball of metal, which by the way is just a bit smaller than the moon!

The reason that the inner core is solid has to do with the incredible pressure of the earth's entire weight pressing inward. The more pressure you put on something, the more heat you need to cause that thing to boil or melt. This is why the metal at

1 (Point to the layers in the diagram as they are named in the read-aloud.)

2 Did you hear the word *heat* again? Heat causes parts of the mantle to move around. Remember, solids keep their shape while liquids move around and can be poured.

3 What does it mean if the inner core is solid?

4 If metal is molten, heat has changed it from solid to liquid.

the very center of the earth—the inner core—is solid instead of liquid. Despite the intense heat, there is simply too much pressure caused by the weight of the rest of the earth, so the center of the earth cannot melt and it remains solid. [5]

5 Did you hear the word *pressure* again? Pressure causes the inner core to be solid rather than liquid. What does it mean if the inner core is solid?

Show image 3A-2: San Bernardino Mountains

The crust upon which we live is constantly being changed and reshaped due to heat and pressure caused by activity in the earth's mantle and core. The San Bernardino Mountains that you see in this picture, along with many other mountains along the West Coast of the United States, from Mexico straight up to Alaska, were created by changes inside the earth.

Show image 3A-3: Diagram of a volcano

Remember, parts of the mantle that are closest to the core are soft and gooey. That hot, gooey material in the mantle does not always stay in the mantle. Sometimes it rises up to the surface. Every so often, some of that extremely hot molten rock, or magma, pushes up through the mantle and forces its way into cracks and crevices in the crust.

Over time, the magma collects in a magma chamber, such as the one near the bottom of the picture. The heat in the magma chamber releases gas from the magma which builds up and creates pressure. The pressure builds and builds until . . . one day . . . BOOM! [6] The magma erupts in a **volcano** of lava, ash, gas, and fire. Once it is released from the earth, the magma becomes lava—flowing liquid rock, which flows across the ground until it cools and hardens into rock once again. [7]

6 Did you hear the words *heat* and *pressure* again? Heat and pressure cause volcanoes to erupt.

7 The eruption of lava, ash, gas, and fire forms a mountain called a volcano.

Show image 3A-4: Volcano [8]

Now that I have told you about volcanoes, let me explain one more thing. Thanks to geologists, we have a pretty good idea when and where these geologic events are likely to occur. Geologists help predict where volcanoes are most likely to occur, and this helps keep people safe by discouraging them

8 What do you see in this picture?

from building homes close to dangerous areas. Unfortunately, sometimes people choose not to listen to our warnings. Also, I need to tell you that we geologists aren't always right. It is not always possible to predict when and where geologic **disasters** will occur, but we work hard to give people as much warning as we can. [9]

9 Disasters are events that cause a lot of damage.

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 the students' responses using richer and more complex language. It is highly recommended that you ask students to answer in complete sentences by asking them to restate the question in their responses.

1. What are the names of the layers of the earth? (crust, mantle, outer core, inner core)
2. How would you describe the mantle? (It contains most of the earth's rock; it gets hotter and softer closer to the core.)
3. How would you describe the outer core of the earth? (melted or molten metal, liquid)
4. How would you describe the inner core? (a solid metal ball) Why is the inner core solid rather than liquid? (because of pressure)
5. Is the outer core solid or liquid? (liquid)
6. What causes a volcano to form? (Hot molten rock or magma inside the earth makes its way to the surface of the earth.)
7. Why is it important for scientists to study volcanoes and keep people informed about them? (to learn more about them and to help keep people safe from geological disasters)

I am going to ask a question. I will give you a minute to think about the question, and then I will ask you to turn to your neighbor and discuss the question. Finally, I will call on several of you to share what you discussed with your partner.

8. *Think Pair Share:* How are the crust, mantle, and core of the earth alike? (They are all layers of the earth; they all contain rock, etc.) How are they different? (Some parts are solid; some parts are liquid; some parts are hotter than others; etc.)

Word Work: Solid (5 minutes)

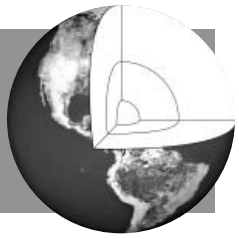
1. The read-aloud said, "High heat causes the materials in the mantle to get mushy, so things move around quite a bit, but in most places it is still *solid* rather than liquid."
2. Say the word *solid* with me.
3. If something is solid, it keeps its shape.
4. It was so cold outside last night that the water puddle became solid ice.
5. What things have you seen that are solid? Try to use the word *solid* when you tell about it. (Ask two or three students. If necessary, guide and/or rephrase the students' responses: "_____ is solid.")
6. What's the word we've been talking about?

Use a *Making Choices* activity for follow-up. Directions: I will name an object. If it is something that is solid, you will say, "solid." If it is something that is not solid, you will say, "not solid."

1. book (solid)
2. milk (not solid)
3. water (not solid)
4. desk (solid)
5. shoe (solid)
6. steam coming out of a hot bowl of soup (not solid)

Complete Remainder of the Lesson Later in the Day

3B The Earth Inside-Out, Part II



Extensions

20 *minutes*

The Layers of the Earth (Instructional Master 3B-1)

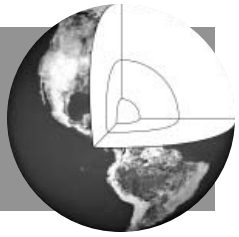
Give each student a copy of Instructional Master 3B-1.

Explain that the worksheet has a diagram of the layers of the earth. Have the students point to and name each layer with you. Ask the students which layer is coolest and which layer is hottest. Have students label the layers using 'C' for crust, 'M' for mantle, 'OC' for outer core, and 'IC' for inner core, Then color the crust brown, the mantle red, the outer core orange, and the inner core yellow.

On the back of the paper, have the students write a sentence about each layer, being sure to use the words *crust, mantle, outer core, and inner core* in their sentences. Some students may need to dictate their sentences to an adult, while others, may write on their own.

Have the students share their sentences with a partner or the entire class.

4 The Earth Inside-Out, Part III



Lesson Objectives

Core Content Objectives

Students will:

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

Language Arts Objectives

Students will:

- Use agreed-upon rules for group discussions, i.e., look at and listen to the speaker, raise hand to speak, take turns, say "excuse me" or "please," etc. (L.1.1)
- Carry on and participate in a conversation over at least six turns, staying on topic, initiating comments or responding to a partner's comments, with either an adult or another child of the same age (L.1.3)
- Prior to listening to a read-aloud, identify (orally or in writing) what they know and have learned that may be related to the specific story or topic to be read aloud (L.1.10)
- Listen to and understand a variety of texts, including fictional stories, fairy tales, fables, historical narratives, informational text, nursery rhymes, and poems (L.1.11)
- Use pictures accompanying the read-aloud to check and support understanding of the read-aloud (L.1.14)

- Learn new words from read-alouds and discussions (L.1.15)
- Answer questions (orally or in writing) requiring literal recall and understanding of the details, and/or facts of a read-aloud, i.e., who, what, where, when, etc. (L.1.17)
- Ask questions to clarify information or the topic in a read-aloud (L.1.18)
- Answer questions that require making interpretations, judgments, or giving opinions about what is heard in a read-aloud, including answering "why" questions that require recognizing cause/effect relationships (L.1.20)
- Compare and contrast (orally or in writing) similarities and differences within a single read-aloud or between two or more read-alouds (L.1.21)
- Retell (orally or in writing) important facts and information from a read-aloud (L.1.36)

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

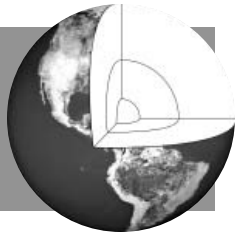
geysers, *n.* Places on the earth where hot water and steam shoot up from inside the earth onto its surface
Example: Many people travel to see the geysers in Yellowstone National Park.
Variation(s): geyser

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

At a Glance	Exercise	Materials	Minutes
Introducing the Read-Aloud	**Brainstorming Links**	chart paper	10
	Purpose for Listening		
Presenting the Read-Aloud	**The Earth Inside-Out, Part III**	U.S. map	15
Discussing the Read-Aloud	**Comprehension Questions**		10
	Word Work: Destructive		5
 **Complete Remainder of the Lesson Later in the Day**			
Extensions	**Venn Diagram**	Instructional Master 4B-1 (optional) chart paper	20

4A The Earth Inside-Out, Part III



Introducing the Read-Aloud

***10** minutes*

Brainstorming Links

Show image 4A-1: Volcano

Ask the students what they see in the picture.

Write the word *volcano* in a circle in the center of a large piece of chart paper. Have the students brainstorm everything that comes to mind when they hear the word *volcano.* Record students' responses on the chart by drawing spokes from the center circle. Tell the 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.

Purpose for Listening

Tell the 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 volcanoes.

Presenting the Read-Aloud — **15** *minutes*

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, if you like that sort of thing. 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] Well, those types of volcanoes do occur, and I'll get to those in a minute. But volcanic activity comes in many different forms, not all of which are as frightening and 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: Map of Hawaii

Hawaii is made up of eight major islands, seven of which are inhabited. [3] All the land of Hawaii was formed by volcanic activity. In other words, if it weren't for volcanoes, Hawaii would not be there at all.

3 meaning that people live on only seven of the islands

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. [4] In Hawaii's case, the volcanic activity started underwater. In fact, most volcanic activity occurs underwater, on some of the deepest parts of the ocean floor. Down there the crust is fairly thin, so it's easier for **magma** to seep up from the mantle. [5]

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

5 Magma is molten or liquid rock that is deep inside the earth. What is it called once it comes to the surface of the earth?

When a volcano erupts underwater, the lava that it releases cools very quickly. Over time—lots of time (millions of years)—this lava piles up. [6] That is what happened in Hawaii. Over time, the lava continually erupting from the hot spot built up a pile that

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

now reaches from the deep ocean floor all the way to the ocean surface, where it became new, dry land.[7]

7 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.[8] 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.

8 (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![9]

9 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.[10] 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

10 *Destructive* means causing damage.

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.

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 plainly that it is not the same mountain it used to be. Mount St. Helens has erupted several more times after that horrifying day in 1980, and it continues to erupt occasionally to this day.

Show image 4A-9: Yellowstone Caldera

Before I go today, I want to tell you about one more place in the United States where there is lots of volcanic activity. This place is called Yellowstone National Park. Yellowstone is in Wyoming, and it is home to many interesting and beautiful sites. [11] Like Hawaii, Yellowstone is situated on top of a hot spot, a place where there is lots of magma close to the surface. But the scene is much different in Yellowstone because the magma has stayed underground and has not erupted onto the surface.

11 (Point out Wyoming on a U.S. map.)

Show image 4A-10: Hot springs and geysers

Yellowstone is still a volcanic hot spot, but you won't find flowing lava on the ground there anymore. Instead, you will find **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. [12] 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. [13] 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.

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

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

The result is a geyser—steam and water spewing up out of the earth. [14] These particular geysers are relatively small. They spurt and bubble all day long in water pools, or springs, which have a

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

pretty, bluish-green color created by certain minerals that collect there.

Show image 4A-11: Old Faithful

This geyser has a name: It's called Old Faithful. The word *faithful* means trustworthy or reliable. [15] 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.

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

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 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 are hot, so keep your distance and take your geologist's advice if he tells you to start running!

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 the students' responses using richer and more complex language. It is highly recommended that you ask students to answer in complete sentences by asking them to restate the question in their responses.

1. Why does Gerry the Geologist say that if it weren't for volcanoes, there would be no state of Hawaii? (The islands were formed because of 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.)
2. What is a hot spot? (a place where there is lots of volcanic activity)
3. In which layer of the earth does magma form? (the mantle)
4. Once magma erupts to the surface of the crust, what is it called? (lava)
5. What is a geyser? (a place where steam and water erupt from the earth)
6. What is "Old Faithful"? (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. How is a volcano like a geyser? How are they different? (They are both eruptions caused by heat and pressure inside the earth; a volcano is an eruption of lava, while a geyser is an eruption of steam and hot water.)
8. Why do you think scientists study volcanoes and geysers? (to learn more about the history of the earth, to help keep people safe)

9. *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.

Word Work: Destructive (5 minutes)

1. The read-aloud said, "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 tornado damaged ten homes in the neighborhood.
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."

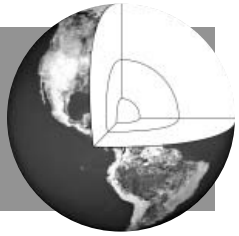
1. The forest fire burned the homes of many animals. (That's destructive.)
2. The winds of the hurricane blew a tree onto my neighbor's car. (That's destructive.)
3. We saw a beautiful rainbow after the thunderstorm. (That's not destructive.)
4. The tornado blew the roof off the grocery store. (That's destructive.)

5. The grass started to turn green after the spring rains. (That's not destructive.)

Note to Teacher: If you have time, you may want to explain that people sometimes choose to be destructive and then give examples of this.

Complete Remainder of the Lesson Later in the Day

4B The Earth Inside-Out, Part III



Extensions

20 *minutes*

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

Create a Venn diagram with two overlapping circles on a large piece of chart paper. Label one circle "volcano" and the other "geyser." Ask the 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 the 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.

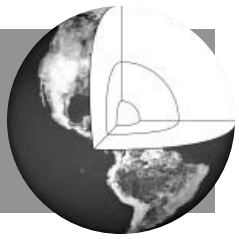
Next, ask students to think about volcanoes and how they are different from geysers. (Volcanoes erupt with lava; volcanoes create mountains, etc.) Record these responses in the "volcano" circle.

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 the 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.

An instructional master of a Venn diagram has been included if you have students who are ready to create the Venn diagram on their own.

PP1 Pausing Point 1



Note to Teacher

This is the end of the read-alouds that focus on the layers of the earth. You may choose to pause here and spend one to two days reviewing, reinforcing, or extending the material taught thus far.

If you do pause, you may have students do any combination of the activities listed below. The activities may be done in any order. You may wish to do one activity on successive days. 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
- Identify the layers of the earth: crust, mantle, core (outer and inner)
- Describe each of the layers inside the earth
- Describe volcanoes and geysers
- Describe how heat, pressure, and time cause many changes inside the earth
- Understand that much of our knowledge of the earth and its history is the result of the work of many scientists

Activities

The Earth's Surface

Materials: Globe

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

Image Review

Show the 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 to 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 an additional trade book to review a particular concept; refer to the books listed in the domain introduction. You may also choose to have the students select a read-aloud to be heard again.

Layers of the Earth

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 the students what it might represent. (mantle) Point to the pit and ask the students what it might represent. (core)

You Were There: Volcanoes and Geysers

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.

Key Vocabulary Brainstorming

Materials: Chart paper

Give the 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 a piece of chart paper for reference.

Riddles for Core Content

Ask the students riddles such as the following to review core content:

- I am the layer of the earth where people live. What am I? (crust)
- I erupt with steam and hot water. What am I? (geyser)
- I am an imaginary line around the outside of the earth at equal distances from the North and South Poles. What am I? (equator)
- I study rocks to learn more about the history of the earth. Who am I? (geologist)

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 the 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 the students a "signal" for each of the words *heat, pressure,* and *time.*

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

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

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

Practice these "signals" until students are comfortable using them.

Tell the 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

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.

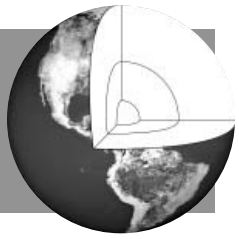
You may also ask students to write individual letters if they are ready to do this activity on their own.

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.

5 Minerals



Lesson Objectives

Core Content Objectives

Students will:

- Identify common minerals in the earth
- Explain how minerals are used by people
- Understand that much of our knowledge of the earth and its history is the result of the work of many scientists

Language Arts Objectives

Students will:

- Use agreed-upon rules for group discussions, i.e., look at and listen to the speaker, raise hand to speak, take turns, say "excuse me" or "please," etc. (L.1.1)
- Carry on and participate in a conversation over at least six turns, staying on topic, initiating comments or responding to a partner's comments, with either an adult or another child of the same age (L.1.3)
- Prior to listening to a read-aloud, identify (orally or in writing) what they know and have learned that may be related to the specific story or topic to be read aloud (L.1.10)
- Listen to and understand a variety of texts, including fictional stories, fairy tales, fables, historical narratives, informational text, nursery rhymes, and poems (L.1.11)
- Use pictures accompanying the read-aloud to check and support understanding of the read-aloud (L.1.14)
- Learn new words from read-alouds and discussions (L.1.15)

- Answer questions (orally or in writing) requiring literal recall and understanding of the details, and/or facts of a read-aloud, i.e., who, what, where, when, etc. (L.1.17)
- Answer questions that require making interpretations, judgments, or giving opinions about what is heard in a read-aloud, including answering "why" questions that require recognizing cause/effect relationships (L.1.20)
- Evaluate and select read-alouds, books, or poems on the basis of personal choice for rereading (L.1.27)
- Share writing with others (L.1.29)

Core Vocabulary

gemstones, *n.* Precious stones that can be cut and polished and used in jewelry
Example: We were amazed at the sizes and brilliant colors of the gemstones on display in the museum.
Variation(s): gemstone

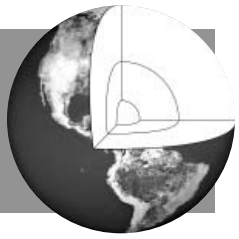
hobby, *n.* An activity done for pleasure in your spare time
Example: He collected old coins as a hobby.
Variation(s): hobbies

minerals, *n.* Natural substances found in rocks or in the ground
Example: Minerals such as diamonds and gold come in many shapes and sizes.
Variation(s): mineral

traces, *n.* Very small amounts
Example: Even after cleaning, there were still traces of dust on his glasses.
Variation(s): trace

At a Glance	Exercise	Materials	Minutes
Introducing the Read-Aloud	**Brainstorming Links**	chart paper	10
	Purpose for Listening		
Presenting the Read-Aloud	**Minerals**		15
Discussing the Read-Aloud	**Comprehension Questions**		10
	Word Work: Hobby	drawing paper, drawing tools	5
 **Complete Remainder of the Lesson Later in the Day**			
Extensions	**Domain-Related Trade Book or Student Choice**	trade book	20
	Rock and Mineral Collections (optional)	rock/mineral collection	
Take-Home Material	**Parent Letter**	Instructional Master 5B-1	

5A Minerals



Introducing the Read-Aloud

***10** minutes*

Brainstorming Links

Write the word *rocks* in a circle in the center of a large piece of chart paper. Have the students brainstorm everything that comes to mind when they hear the word *rocks.* Record students' responses on the chart by drawing spokes from the center circle. Tell the 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.

Purpose for Listening

Tell the students that in the next read-aloud, Gerry the Geologist is going to share his rock collection with them. Tell the class that Gerry will also explain that rocks are made of minerals. Tell the students to listen carefully to learn more about minerals.

Presenting the Read-Aloud — *15 minutes*

Minerals

Show image 5A-1: Gerry with his rock collection

You know that I work as a geologist for a living, which means that it is my job to study rocks. But I also have a little **hobby** I want to share with you. Do you know what a hobby is? A hobby is something that a person enjoys doing in his or her spare time. Some people like to make models or draw pictures in their spare time; some people like to bake cookies or grow flowers or play games; and some people collect things like coins, toys, stickers, and—of course—rocks! If you ask me, rock collecting is the greatest hobby of all!

1 What colors do you see?

Show image 5A-2: Polished gemstones [1]

Here are some of the rocks and minerals from my collection. I have polished these in a special machine called a rock tumbler, which makes them shiny and really brings out the color. Let's see, in this pile alone I can see amethyst, tiger's eye, rose quartz, turquoise, red jasper, agate, unakite, onyx . . . Whoa! Sorry, I get carried away sometimes.

In addition to showing off my knowledge about rocks, I was trying to make a point: There are many, many different kinds of rocks out there in the world. I've been hunting rocks almost all of my life, and I still haven't found half the rocks there are to find. I probably never will, but I'll keep looking just the same.

Show image 5A-3: Milky quartz

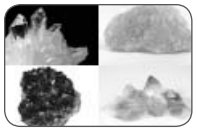
Minerals are the building blocks of rocks. That is to say, all rocks contain minerals. Sometimes you can find pure minerals unmixed with other minerals. But most rocks contain several different minerals. There are over three thousand different types of minerals, and scientists still discover new ones from time to time.

Minerals come in all different shapes, sizes, colors, and textures. We use these different characteristics to divide minerals

into groups. Some of these mineral groups are quite common, while others are very unusual and even difficult to describe. I will tell you about a few of the best known minerals.

For instance, this is a picture of the mineral quartz. Quartz is the most common mineral in the earth's crust—not the most common in the whole earth, mind you, just the crust.[2] Specifically, this picture shows milky quartz, which is not too impressive or pretty looking. However . . .

2 What is the crust of the earth?



Show image 5A-4: Varieties of quartz

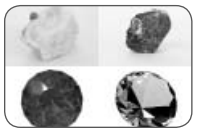
Quartz comes in many varieties. Those are clear quartz crystals on the top left. Some minerals form into perfect crystals like these, and some don't. It all depends on where and how they are formed within the earth.

Crystals can come in all different sizes. Some are as small as a pea; some are as long as your arm or longer.

It all depends! As for the color variations[3] in different types of quartz, these are largely caused by the addition of very small amounts of various types of metals into the mineral. For instance, the beautiful purple color of amethyst is caused by **traces** of iron and aluminum metal.[4]

3 or color differences

4 Traces are small amounts.



Show image 5A-5: Ruby and sapphire

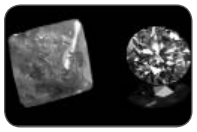
Examples of rare **gemstones** are some varieties of corundum—a mineral composed mostly of aluminum and oxygen.[5] Red corundum is known as ruby, and blue corundum is known as sapphire. I need one of these in my collection. Rubies and sapphires are among the most beautiful mineral crystals on earth.

5 A gemstone is a stone that is cut and polished to be used in jewelry. Can you find the gemstones in the image?

Show image 5A-6: Emerald

Here is another beauty. This is called emerald. Emerald is a variety of the mineral beryl, which also comes in many different colors, including green, blue, yellow, and red. Deep-green emerald is my favorite.[6]

6 (Have a student point to the gemstone.)



Show image 5A-7: Diamonds

And here is one of the most famous minerals. Do you know what these beauties are called? [7] These are diamonds. A diamond is the hardest mineral in the whole world. A diamond is hard enough to cut through glass or scratch other minerals. The diamond on the left is a raw diamond, fresh from the earth. The diamond on the right has been cut and polished. The sides of a cut diamond are called facets.

7 (Pause for students to answer.)

By the way, I don't have any precious gemstones like this in my collection. They are simply too expensive and too hard to find, but I bought one for my wife when we got married. Some people give diamonds or other precious gemstones as gifts to the people they love. But diamonds are very expensive, so it's not the kind of gift you give to just anyone.

Show image 5A-8: Jeweler looking at diamond

You need special equipment and skills to cut and polish diamonds or other gemstones such as rubies and emeralds. If you don't cut and polish them, then they are still pretty, but not as pretty. People who cut diamonds look through powerful magnifying glasses as they do their work. This is so they can see all the tiny little facets or sides. [8]

8 (Explain that the inset shows what the jeweler sees through the magnifying glass.)

Show image 5A-9: Salt

Okay, enough of the fancy, pretty minerals. Let's get back to the basics. Have you ever heard of salt? [9] Salt is a common mineral. Salt is the reason the oceans are, well, salty. There are many different types of salt in the world, but the one I am talking about is sodium chloride, better known as table salt. Why is it called table salt? Have you ever seen anyone sprinkle a little salt from a salt shaker onto their food? And where do they keep the salt shaker? On the table!

9 (Pause for students to answer.)

Some people put salt on food to make it taste better. In fact, salt is an extremely important nutrient for people as well as animals. Your body needs salt—not too much, but just enough.

Too much salt is bad for you. If you eat too much salt, your body will tell you so because you will feel thirsty.

Salt appears in many forms in nature. You can't see salt in water because it dissolves, but you'll know it's there if you ever taste ocean water. Salt can also be found in the form of halite crystals, like the square-shaped crystal pictured here.

Show image 5A-10: Gerry pointing to a blackboard

How do all these different minerals wind up looking the way they do? Each has its own story—and it gets pretty complicated—but you can bet that there were three basic things in common: [10] heat, pressure, and time. These three factors play a role in the formation of every mineral.

10 Do you know what three things Gerry is thinking of?

Show image 5A-11: Gerry with his rock collection

I've told you a bit about some of my favorite minerals, some of which are in my rock collection and some of which I only wish I had. The best part about rock hunting as a hobby is that you don't need many special tools to do it. All you have to do is walk around looking at the ground, and when you see a rock that looks interesting, pick it up, put it in your pocket, and take it home to add to your collection. Take a look at the ground the next time you go outside, and see if you find anything interesting.

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 the students' responses using richer and more complex language. It is highly recommended that you ask students to answer in complete sentences by asking them to restate the question in their responses.

1. What is Gerry the Geologist's hobby? (collecting rocks)
2. Why do you think he might have chosen this hobby? (because he studies rocks and enjoys learning about them)
3. What are minerals? (what rocks are made of)
4. Do you remember the names of any minerals that you heard about? [Note to Teacher: You may want to show images 5A-3 through 5A-7 and image 5A-9 as clues.] (quartz, ruby, sapphire, emerald, diamond, salt)
5. How are minerals used by people? (as gemstones, for flavoring food)
6. Where might you find the mineral salt? (in the oceans, in the kitchen, in a salt shaker)
7. How do people like Gerry know so much about minerals? (because he has studied them and because of the work of many other scientists)

I am going to ask a question. I will give you a minute to think about the question, and then I will ask you to turn to your neighbor and discuss the question. Finally, I will call on several of you to share what you discussed with your partner.

8. *Think Pair Share:* Which of the minerals that you heard about is your favorite? Why? (Answers may vary.)

Word Work: Hobby (5 minutes)

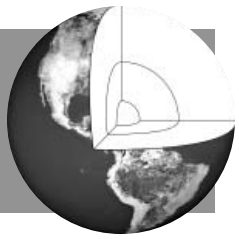
1. In the read-aloud, Gerry said, "But I also have a little *hobby* I want to share with you."
2. Say the word *hobby* with me.
3. A hobby is something you do for fun in your spare time.
4. Gardening has been my grandmother's hobby for many years.
5. Do you have a hobby, or is there a hobby that you would like to start? Try to use the word *hobby* when you tell about it. (Ask two or three students. If necessary, guide and/or rephrase the students' responses: "My hobby is . . .")
6. What's the word we've been talking about?

Use a *Drawing/Writing* activity for follow-up. Directions: I am going to give you a piece of drawing paper. I would like for you to draw a picture of one of the hobbies that you have or a hobby that you would like to start. After you have drawn your picture, write a sentence telling about the hobby. Be sure to use the word *hobby* in your sentence.

Some students may need to dictate the sentence to an adult while others may write the sentence independently. Give the students time to share their sentences with a partner or the entire class.

Complete Remainder of the Lesson Later in the Day

5B Minerals



Extensions

20 minutes

Domain-Related Trade Book or Student Choice

Domain-Related Trade Book

Refer to the list of recommended trade books in the domain introduction at the front of this teacher's guide, and choose one to read aloud to the class. As you read, use the same strategies that you have been using when reading the read-aloud selections in this anthology—pause and ask occasional questions; rapidly clarify critical vocabulary within the context of the read-aloud; etc. After you finish reading the trade book aloud, lead students in a discussion as to how the story or information in this book relates to the read-alouds in this domain. Discuss whether the trade book was fiction or nonfiction, fantasy or reality, historical or contemporary.

You may also ask students to write about the most interesting thing they learned from the trade book. You may suggest how to begin the sentence by writing on the board, "The most interesting thing that I learned was . . ."

Student Choice

Ask the students which one of the read-alouds they have heard recently that they would like to hear again. If necessary, reread the titles of recent read-alouds to refresh the students' memories. You may also want to choose one yourself.

Reread the text that is selected. Feel free to pause at different places in the read-aloud this time and talk about vocabulary and information that you did not discuss previously during the read-aloud.

After the read-aloud, ask students if they noticed anything new or different during the second reading that they did not notice during the first reading. Also, ask them to try to express why they like this

read-aloud. Remember to repeat and expand upon each response using richer and more complex language, including, if possible any read-aloud vocabulary.

Rock and Mineral Collections (optional)

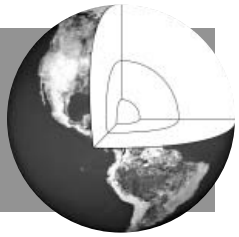
If your school has a rock or mineral collection, you may want to share it with your class.

If feasible, you may invite students to find and bring in interesting rocks to share with the class.

Parent Letter

Send home Instructional Master 5B-1.

6 The Three Types of Rocks



Lesson Objectives

Core Content Objectives

Students will:

- Identify the three types of rocks: metamorphic, sedimentary, and igneous
- Describe how heat, pressure, and time cause the formation of metamorphic, sedimentary, and igneous rocks
- Understand that much of our knowledge of the earth and its history is the result of the work of many scientists

Language Arts Objectives

Students will:

- Use agreed-upon rules for group discussions, i.e., look at and listen to the speaker, raise hand to speak, take turns, say "excuse me" or "please," etc. (L.1.1)
- Carry on and participate in a conversation over at least six turns, staying on topic, initiating comments or responding to a partner's comments, with either an adult or another child of the same age (L.1.3)
- Prior to listening to a read-aloud, identify (orally or in writing) what they know and have learned that may be related to the specific story or topic to be read aloud (L.1.10)
- Listen to and understand a variety of texts, including fictional stories, fairy tales, fables, historical narratives, informational text, nursery rhymes, and poems (L.1.11)
- Use pictures accompanying the read-aloud to check and support understanding of the read-aloud (L.1.14)

- Learn new words from read-alouds and discussions (L.1.15)
- Answer questions (orally or in writing) requiring literal recall and understanding of the details, and/or facts of a read-aloud, i.e., who, what, where, when, etc. (L.1.17)
- Ask questions to clarify information or the topic in a read-aloud (L.1.18)
- Answer questions that require making interpretations, judgments, or giving opinions about what is heard in a read-aloud, including answering "why" questions that require recognizing cause/effect relationships (L.1.20)
- With assistance, categorize and organize facts and information within a given domain (L.1.38)

Core Vocabulary

artifacts, *n.* Items from long ago made by people
Example: There were many artifacts at the museum, including jars and bowls.
Variation(s): artifact

igneous, *adj.* A type of rock that forms when molten rock cools, hardens, and turns solid
Example: Obsidian and granite are two types of igneous rocks.
Variation(s): none

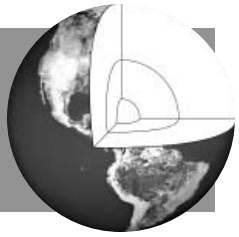
metamorphic, *adj.* A type of rock that has formed from another rock as a result of heat and/or pressure
Example: Marble is a metamorphic rock formed from limestone, a sedimentary rock.
Variation(s): none

sedimentary, *adj.* A type of rock that has formed as the result of layers of sediment pressed together
Example: Coal is a type of sedimentary rock used as an energy source.
Variation(s): none

sediments, *n.* Small, solid pieces of material often carried and moved around by the wind and weather
Example: Sediments settled at the bottom of the swimming pool.
Variation(s): sediment

At a Glance	Exercise	Materials	Minutes
Introducing the Read-Aloud	**What Have We Already Learned?**	Image Cards 1–3	10
	Purpose for Listening		
Presenting the Read-Aloud	**The Three Types of Rocks**		15
Discussing the Read-Aloud	**Comprehension Questions**		10
	Word Work: Sediments		5
 **Complete Remainder of the Lesson Later in the Day**			
Extensions	**Three-Column Chart: Types of Rocks**	Instructional Master 6B-1 (optional) chart paper	20

6A The Three Types of Rocks



Introducing the Read-Aloud

***10** minutes*

What Have We Already Learned?

Ask the students if they can remember the three words that Gerry the Geologist said they should always keep in mind when thinking about rocks. (heat, pressure, and time) You may use Image Cards 1–3 as clues. Ask students to share what they have learned about how heat, pressure, and time affect things on the earth. Again you may want to give clues such as, "Do heat, pressure, or time cause volcanoes? Geysers? The layers of the earth?" Remember to repeat and expand upon each response using richer and more complex language, including, if possible, any read-aloud vocabulary.

Tell the students that all rocks can be sorted into three categories because of how they are formed by heat, pressure, and time.

Purpose for Listening

Tell the students to listen carefully to learn about the three types of rocks and how they are formed.

Presenting the Read-Aloud — **15** *minutes*

The Three Types of Rocks

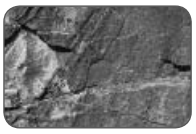
Show image 6A-1: Gerry pointing to a blackboard

The right amount of heat can turn a solid rock or metal into a liquid.[1] Pressure from the weight of the earth and movement of materials inside the earth can crush rocks. Over time, the effects of heat and pressure create the rock formations and other geologic phenomena that we find in the world.

1 What is the difference between solid rock and liquid rock?

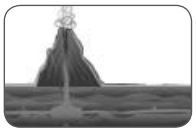
Working together, heat, pressure, and time create the three types of rocks that exist in the world. You heard me right: every rock in the world can be placed into one of three categories. The three types of rocks are **igneous, sedimentary,** and **metamorphic.** Try saying each of these rock types out loud: igneous . . . sedimentary . . . metamorphic.[2]

2 (Say each word and have students repeat it.) What are the three types of rock?



Show image 6A-2: Granite surface

The first rock type, igneous, is the most common. Igneous rocks come in many forms. Some form entire mountains, and some appear as boulders jutting from the earth. This picture shows a close-up of one type of igneous rock. It may look like a plain, old, gray rock—well, that's because it *is* just a plain, old, gray rock—but it contains different types of minerals, and it hasn't always been a plain, old, gray rock.



Show image 6A-3: Diagram of magma movement

The word *igneous* comes from the Latin word for *fire,* because igneous rocks begin deep down in the heat of the earth's mantle. The earth's mantle is full of a hot, gooey, oozing substance known as magma, or melted rock. The magma is constantly being forced toward the surface by pressure from within the earth. As it travels upward from the mantle through the crust, the magma begins to cool and harden. Sometimes, the magma will erupt from a volcano, but sometimes, the conditions aren't quite right for an eruption.[3]

3 So over time, heat forms magma, and pressure moves the magma. When the lava cools, it forms what type of rock?

Show image 6A-4: Half Dome, Yosemite National Park

This formation is called Half Dome, and it is located in Yosemite National Park in California. When you look at Half Dome, you are looking at an old magma chamber. A magma chamber is a pocket in the earth's crust where magma collects. As more magma enters the chamber, it gets hotter and pressure builds, and the magma can force its way up to the surface in the form of a volcano.

Or, sometimes, as in the case of Half Dome, the magma just gathers in the chamber and that's that—no eruption. For whatever geologic reason, the heat and pressure did not get great enough to force the magma through the crust and onto the surface in the form of lava. Instead, the magma cooled and hardened within the chamber. Over millions of years, the rocks and soil around the chamber eroded away, leaving beautiful Half Dome alone sticking high up above the earth. Half Dome is one big igneous rock.

Show image 6A-5: Sill

Another type of igneous formation occurs when magma intrudes, or pushes itself, between two existing layers of rock. This means that not all the layers in this mountain were formed one on top of the other. Rather, some of the layers forced their way in between other rocks.

Show image 6A-6: Obsidian

This is my favorite type of igneous rock: obsidian, better known as volcanic glass. Volcanic glass forms when certain types of lava cool and harden, becoming smooth, shiny, and glasslike. Not all lava becomes volcanic glass. It all depends on the chemistry of the magma and other conditions.

Show image 6A-7: Obsidian spearhead

Some Native Americans used volcanic glass to make arrowheads and spearheads. If you break a piece of volcanic glass, you will find that it is incredibly sharp and strong. Every now and then I find ancient **artifacts** like this when I'm out rock hunting.[4]

4 Artifacts are objects from long ago that were made by people. Which type of rock have you heard about so far: igneous, sedimentary, or metamorphic?

Show image 6A-8: Bryce Canyon

After igneous, the second major rock type is sedimentary. Sedimentary rocks are not formed like igneous rocks, which form from cooled magma. In fact, heat does not play much of a role at all in the formation of sedimentary rocks. Instead, pressure and time are the most important factors in the formation of sedimentary rocks.[5]

5 Of heat, pressure, and time, which two are most important in forming sedimentary rocks?

Show image 6A-9: Sediments

The word ***sediments*** refers to tiny little particles, such as dirt or rock, which are carried along in water, ice, wind, or landslides.[6] If you dump a spoonful of sand into a glass of water, for instance, you will see the sand gradually sink down and settle on the bottom of the glass, much in the way sediments settle on the bottoms of lakes and oceans. Sediments are always floating around in lakes, oceans, and rivers. Over time, sediments in lake water settle and form a thick sludge on the bottom of a lake. As more and more sediments settle on the bottom, more and more weight presses down on the sludge. Over time, the pressure from the weight of the upper sediments can cause the sludge to harden into rock.[7]

6 So sediments are little tiny pieces of dirt and rock. Do you hear the word *sediment* in sedimentary? What do you think sedimentary rocks might be made from?

7 So, how are sedimentary rocks formed?

Show image 6A-10: Bryce Canyon

Sandstone is one common type of sedimentary rock. Wherever you find sandstone, there is a good chance that you are walking in a place that used to be completely underwater. At one time or another, every place on earth has been completely submerged in water. Thus, sandstone is quite common throughout the world. This photo was taken in Bryce Canyon, in the state of Utah, which is known for its unique sandstone formations.

Show image 6A-11: Antelope Canyon

Here is another sandstone canyon I thought you would like to see. Antelope Canyon, in Arizona, is a very special place. It is known as a slot canyon, which is formed over millions of years as water from rain and floods rushes through the sandstone, causing it to erode.

Show image 6A-12: Limestone cliffs

These cliffs are made of limestone, another type of sedimentary rock. Limestone is interesting because it is composed mainly of minerals left over from ancient sea creatures like clams, oysters, and other shellfish. When these creatures died, their shells sank down to the ocean floor and settled with the other sediments. Over time, the churning oceans ground the shells into a fine white powder. The powder settled and more shells and sediments put pressure on it. It took millions and millions of years, but eventually all the powdery shell leftovers were compressed into limestone. [8]

8 Did you hear the words *pressure* and *time*? With pressure and a long, long period of time, the shells of sea creatures turned into sedimentary rock. Which two types of rocks have you learned about so far? Hint: One is formed by cooled magma and the other is made of sediments.

Show image 6A-13: Limestone to marble

If limestone is subjected to intense pressure for an even longer period of time, it can turn into another kind of rock called marble.

Marble is very hard, and it often has a beautiful, pure white color. People have used marble for thousands of years to make fine buildings and sculptures.

Marble is known as a metamorphic rock, which is the third and least common type of rock. *Metamorphic* comes from the Greek word for transformation, or change. Metamorphic rocks are formed when other types of rocks undergo intense heat and pressure and change, or metamorphose, into new kinds of rocks. [9]

9 What's the third type of rock, formed when heat and pressure change igneous and sedimentary rocks into new kinds of rocks?

Show image 6A-14: Three types of rock

Congratulations! You are becoming a geologist! Now you know about the three rock types: igneous, sedimentary, and metamorphic. Won't everyone be impressed when you tell them about the new words you learned?

Discussing the Read-Aloud **15** *minutes*

Comprehension Questions **(10** minutes**)**

1. What are the three types of rocks? (metamorphic, sedimentary, igneous)
2. How are igneous rocks formed? Remember: *Igneous* means "fire." (from hot magma or lava that cools and hardens)
3. How are sedimentary rocks formed? (Sediments settle and form a thick sludge on the bottom of a lake that thickens over time; the pressure from the weight of the sediments makes it harden into rock.)
4. How are metamorphic rocks formed? (heat and pressure change igneous and sedimentary rocks into new rocks)
5. How are heat, pressure, and time important in the formation of igneous rocks? (Heat forms magma; pressure moves the magma; these take place over time.)
6. How are pressure and time important in the formation of sedimentary rocks? (Pressure changes sediments to rock over time.)
7. How are heat, pressure, and time important in the formation of metamorphic rocks? (Heat and pressure change rocks over time to become metamorphic rocks.)
8. How do we know how igneous, sedimentary, and metamorphic rocks are formed? (through the work of many scientists)
9. *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.

Word Work: Sediments (5 minutes)

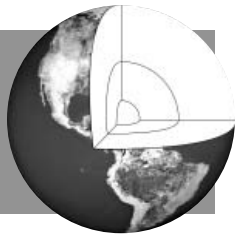
1. The read-aloud said, "*Sediments* are always floating around in lakes, oceans, and rivers."
2. Say the word *sediments* with me.
3. Sediments are tiny particles of dirt or rock that are moved by wind or water. [Note to Teacher: You may want to put some sediment in a plastic container of water for students to observe.]
4. I noticed sediments in the swimming pool.
5. What are some other places that you might see sediments? Try to use the word *sediments* when you tell about it. (Ask two or three students. If necessary, guide and/or rephrase the students' responses: "I saw sediments in . . .")
6. What's the word we've been talking about?

Use a *Making Choices* activity for follow-up. Directions: I will describe some objects. If I describe sediments, you will say, "Those are sediments." If I do not describe sediments, you will say, "Those are not sediments."

1. I noticed tiny specks of dirt in my glass of water. (Those are sediments.)
2. The ants crawled through the blades of grass. (Those are not sediments.)
3. The wind blew small bits of dust all over the car. (Those are sediments.)
4. Dad cleaned the small grains of sand out of the bathtub. (Those are sediments.)
5. The museum has many large gemstones. (Those are not sediments.)

Complete Remainder of the Lesson Later in the Day

6B The Three Types of Rocks



Extensions

20 *minutes*

Three-Column Chart: Types of Rocks (Instructional Master 6B-1, optional)

On a large piece of chart paper, create a chart similar to the one below:

igneous	sedimentary	metamorphic

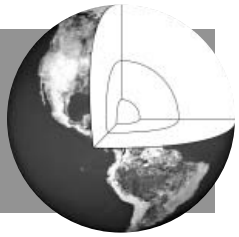
Ask the students to think about what they learned from the read-aloud about the three types of rocks. Have students share what they learned about igneous rocks. Record students' responses on the chart paper. Tell the students that you are going to write down what they say, but that they are not expected 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.

Follow the same procedures for filling in "sedimentary" and "metamorphic."

Once the chart has been completed, read it to the class.

An optional instructional master has been included if you have students who are ready to fill in the chart on their own.

7 Ores, Mining, and Quarries



Lesson Objectives

Core Content Objectives

Students will:

- Describe how rocks and minerals are taken from the earth
- Understand that much of our knowledge of the earth and its history is the result of the work of many scientists

Language Arts Objectives

Students will:

- Use agreed-upon rules for group discussions, i.e., look at and listen to the speaker, raise hand to speak, take turns, say "excuse me" or "please," etc. (L.1.1)
- Carry on and participate in a conversation over at least six turns, staying on topic, initiating comments or responding to a partner's comments, with either an adult or another child of the same age (L.1.3)
- Prior to listening to a read-aloud, identify (orally or in writing) what they know and have learned that may be related to the specific story or topic to be read aloud (L.1.10)
- Listen to and understand a variety of texts, including fictional stories, fairy tales, fables, historical narratives, informational text, nursery rhymes, and poems (L.1.11)
- Use pictures accompanying the read-aloud to check and support understanding of the read-aloud (L.1.14)
- Learn new words from read-alouds and discussions (L.1.15)

- Answer questions (orally or in writing) requiring literal recall and understanding of the details, and/or facts of a read-aloud, i.e., who, what, where, when, etc. (L.1.17)
- Answer questions that require making interpretations, judgments, or giving opinions about what is heard in a read-aloud, including answering "why" questions that require recognizing cause/effect relationships (L.1.20)
- Retell (orally or in writing) important facts and information from a read-aloud (L.1.36)

Core Vocabulary

miners, *n.* People whose job it is to take ore or minerals from the earth
Example: The miners worked to take coal from the earth.
Variation(s): miner

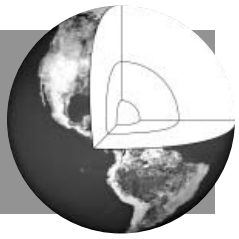
mine, *v.* To take or extract ore or minerals from the earth
Example: The geologists are looking for the best place to mine gold.
Variation(s): mines, mined, mining

ore, *n.* A mineral that contains a useful substance such as a metal
Example: Iron is a type of ore used in building skyscrapers and other things.
Variation(s): ores

quarries, *n.* Places where stone, sand, and/or gravel are cut from the ground
Example: Far from the city, limestone was found in two large quarries.
Variation(s): quarry

At a Glance	Exercise	Materials	Minutes
Introducing the Read-Aloud	**What Have We Already Learned?**		10
	Purpose for Listening		
Presenting the Read-Aloud	**Ores, Mining, and Quarries**		15
Discussing the Read-Aloud	**Comprehension Questions**		10
	Word Work: Mine		5
Complete Remainder of the Lesson Later in the Day			
Extensions	**Image Review**		20

7A Ores, Mining, and Quarries



Introducing the Read-Aloud

***10** minutes*

What Have We Already Learned?

Ask the students if they can name the three types of rocks. Then ask them to share what they remember about igneous, sedimentary, and metamorphic rocks. You may also choose to read the chart that was created in the extension activity in Lesson 6.

Remind students that rocks are made of minerals, if this has not already been shared. Ask students to share what they have learned about minerals. You may want to show and have students talk about images 5A-3 through 5A-7 and image 5A-9.

Purpose for Listening

Tell the students that often rocks and minerals are dug from the earth's crust. Tell the students to listen carefully to learn how this is done.

Presenting the Read-Aloud **15** *minutes*

Ores, Mining, and Quarries

Show image 7A-1: Coal

People can use rocks and minerals for all sorts of important things. Today I am going to show you how people get important minerals and rocks out of the earth. Let's start with coal. You can see a big pile of it here in this picture.

Coal is a type of sedimentary rock, and it is a little like limestone because both began as living things. As you may recall, limestone comes from the shells of ancient sea creatures. Well, coal comes from decayed plants that have been under pressure for millions of years.[1] Coal is an important energy source. People burn coal in order to create electricity for homes and to make energy to power machines in factories.[2]

1 Did you hear the word *pressure*? Lots of pressure over a long period of time can cause rotting plants to turn into coal.

2 So why is coal important?

Show image 7A-2: Coal mine entrance

People get coal and other important rocks, minerals, and metals by mining them from the earth. One way to **mine** coal is by digging a mineshaft, or tunnel, deep down into the earth.[3] This is a picture of an entrance to a coal mine. There are **miners** working down there right now.[4]

3 So, to *mine* a rock or mineral from the earth means to dig it out of or cut it from the earth.

4 Miners are people whose job it is to mine rocks or minerals.

Show image 7A-3: Coal mine[5]

The first thing to remember about mines is that they are dangerous places, and mining is very dangerous work. One danger in mining is the threat that the mineshaft can collapse[6] and trap the miners inside, so they built this strong frame to support the walls of the mine.

5 Do you see the tracks in the image? This is how the carts get in and out of the mine.

6 or fall down

Show image 7A-4: Coal miner

Here is a miner hard at work. Notice she is wearing a helmet, because it is easy to bump your head in the mine, and you never know when a rock might break loose and fall from above.

And what is that thing on the front of her helmet? It is called a headlamp. The headlamp is a flashlight that she wears on her head so her hands are free to work.

Also, you probably notice that this miner is dirty. That's because coal mining is a dirty business.

Show image 7A-5: Train cars loaded with coal

After digging and drilling the coal from the walls of the mine, the miners load it into the carts and send it back up to the surface. From there it will be loaded onto larger trains and sent to electrical power plants, factories, or wherever the coal is needed. [7]

7 Don't forget: We mine coal to use it to make electricity.

Show image 7A-6: Iron ore

This reddish rock is called iron **ore.** [8] An ore is a rock that contains minerals or metals. There are many different types of ores in the world, but iron ore is one of the most important. Iron ore is the source of iron, a strong metal which is used to make steel. Steel, in turn, is used to build bridges, cars, buildings, tools, and other things you see and use every day. [9]

8 Say the words *iron ore* with me.

9 What do we use iron ore to make?

Show image 7A-7: Strip mining

Digging a shaft is just one way to get to mineral resources, and people have been doing it for hundreds and thousands of years. However, modern technology and machines have changed mining. [10] This is a picture of a strip mine. In strip mining, the workers literally strip away layers of the earth using giant earth-moving machinery. Iron ore is often gathered from huge strip mines like this. You know that there is iron here because of the reddish color on the cliffs. [11]

10 That means today we have machines to help with mining.

11 (You may want to pause and explain that while some people think that strip mining is valuable, other people think that it is harmful to the earth.)

Show image 7A-8: Granite quarry

I've now told you about how coal and iron ore are mined. Coal is used for electricity and iron ore is used to make steel metal that is used in tools, cars, and lots of things. Would you like to know how we mine for rocks used in building walls and roads? Look at this picture. Gravel and other stones are gathered from **quarries.**

A quarry is a type of mine, but it is a little different than the other mines I have told you about. Quarries are places where workers gather rocks that are used for building walls or roads.

Show image 7A-9: Quarry blast

Digging is one way to make a mine or quarry, but digging takes a long time and is difficult. Often it is much easier to blast the rocks with dynamite. Here is a picture of a dynamite blast at a rock quarry. Stand back!

Show image 7A-10: Gravel pile

Gravel, or small rocks, can be found in nature, especially in riverbeds or on beaches. People can also make their own gravel by crushing larger rocks. To make this gravel, workers blasted away at the rock in the quarry. Then they gathered the large chunks, crushed them in a special machine appropriately called a rock crusher, and dumped the resulting gravel into this pile. From here the gravel can be loaded onto dump trucks or railcars and sent off to wherever it is needed. Gravel is used to make roads. It is also a key ingredient in concrete, or cement, which is used to make buildings and sidewalks. [12]

12 So in a quarry, which is a kind of mine, miners blast away rock chunks and grind them to make gravel. What is gravel used for?

Show image 7A-11: Geologist in gold mine

So, where do geologists fit into all this? There wouldn't be mines or quarries if it weren't for geologists. If you want coal, you don't just go and start digging a hole and hope you will find it. First, you call a geologist, and he or she can figure out where coal is likely to be. Only people with knowledge of geology know where to look for specific types of rocks and minerals.

This is my friend Albert. He is a geologist, too. A gold-mining company asked Albert to help them find some gold. [13] Albert took them to a place where he thought there was likely to be gold and told them to drill deep down into the bedrock. Then they took some dynamite and blasted out a large room-like area underground. Once the smoke and dust cleared, Albert went in with his rock hammer to look for samples.

13 Can you name something we use gold for?

Show image 7A-12: Gold vein in quartz

Gold is hard to find, and sometimes Albert is wrong. In this case, however, Albert found exactly what he was looking for. Here is a picture of a gold vein Albert found in a chunk of quartz. There must be more gold where that came from, so now the mining company will hire some miners to go down and dig some more. Geologists use their knowledge of the history of the earth to help other people find the rocks, metals, and minerals they need.

Discussing the Read-Aloud ***15** minutes*

Comprehension Questions **(10** minutes**)**

1. Why is coal important to people? (We burn coal in order to create electricity for homes and to make energy to power machines in factories.)
2. Can we go out to the playground or our backyards and pick up coal? (no) Why not? (It has to be mined from the earth.)
3. What does it mean to mine a rock or mineral from the earth? (dig it out of or cut it from the earth)
4. Is mining an easy job or a difficult job? Why? (difficult because it is hard work, dangerous, and dirty)
5. Why do you think miners do this difficult job? (Answers may vary.)
6. What tools help miners with mining? (headlamps, helmets, machines, dynamite, etc.)
7. Why do miners mine iron ore? (to get the metal iron, which is used to make steel for building bridges, cars, buildings, tools, etc.)
8. A quarry is a type of mine where rocks are blasted and put in a rock crusher to make gravel. What is gravel used for? (It is used to make roads and concrete, or cement, which is used to make buildings and sidewalks.)
9. How do geologists like Gerry help miners? (They help them find good places for mining.)

I am going to ask a question. I will give you a minute to think about the question, and then I will ask you to turn to your neighbor and discuss the question. Finally, I will call on several of you to share what you discussed with your partner.

10. *Think Pair Share:* How would things be different if there were no mines? (Answers may vary but should get at the fact that there would not be as many rocks and minerals to be used by people for making electricity, cars, bridges, buildings, sidewalks, tools, jewelry, etc.)

Word Work: Mine (5 minutes)

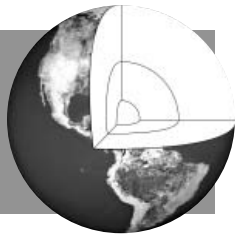
1. The read-aloud said, "One way to *mine* coal is by digging a mineshaft, or tunnel, deep down into the earth.
2. Say the word *mine* with me.
3. *Mine* means to take rocks, minerals, or ore from the earth.
4. It takes many miners and machines to mine enough coal for power plants across the country.
5. Do you think it is important to mine rocks and minerals from the earth? Try to use the word *mine* when you tell about it. (Ask two or three students. If necessary, guide and/or rephrase the students' responses: "I think it is important to mine coal because . . .")
6. What's the word we've been talking about?

Use a *Making Choices* activity for follow-up. Directions: Pretend you are a miner. I will name two objects. Decide which one you might mine. Be sure to use the word *mine* in your response.

1. coal or trees (I might mine coal.)
2. apples or gravel (I might mine gravel.)
3. water or iron ore (I might mine iron ore.)
4. diamonds or grass (I might mine diamonds.)
5. gold or dirt (I might mine gold.)

Complete Remainder of the Lesson Later in the Day

7B Ores, Mining, and Quarries



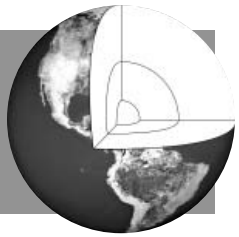
Extensions

***20** minutes*

Image Review

One by one, show images 7A-1 through 7A-12. Ask students to explain what is happening in each picture. Help them to create a continuous narrative of mining coal, mining iron ore, mining for rocks to make gravel, and then mining for gold. As the students discuss each image, remember to repeat and expand upon each response using richer and more complex language, including, if possible, any read-aloud vocabulary.

PP2 Pausing Point 2



Note to Teacher

This is the end of the read-alouds that focus on rocks and minerals. You may choose to pause here and spend one to two days reviewing, reinforcing, or extending the material taught thus far.

If you do pause, you may have students do any combination of the activities listed below. The activities may be done in any order. You may wish to do one activity on successive days. 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 the three types of rocks: metamorphic, sedimentary, and igneous
- Identify common minerals in the earth
- Explain how minerals are used by people
- Describe how rocks and minerals are taken from the earth
- Describe how heat, pressure, and time cause many changes inside the earth
- Understand that much of our knowledge of the earth and its history is the result of the work of many scientists through the years

Activities

Image Review

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

Image Card Review

Materials: Image Cards 7 (igneous rock), 8 (sedimentary rock), and 9 (metamorphic rock)

Divide the class into three groups. Give each group one of the image cards. Give the groups a few minutes to brainstorm everything they remember about the particular type of rock. Then come together as a class and give each group a chance to share.

Domain-Related Trade Book or Student Choice

Materials: Trade book

Read an additional trade book to review rocks and minerals; refer to the books listed in the domain introduction.

You may also choose to have the students select a read-aloud to be heard again.

You Are There: In a Mine or at a Quarry

Have students pretend that they are visiting or working in a mine or at a quarry. Ask students to describe what they see and hear. For example, for "coal mine" students may talk about seeing headlamps, carts of coal, etc. They may talk about hearing the drill, the coal being loaded into carts, etc. Consider also extending this activity by adding group or independent writing opportunities associated with the "You Are There" concept. For example, ask students to pretend they are newspaper reporters describing the work in a mine or at a quarry.

Key Vocabulary Brainstorming

Materials: Chart paper

Give the students a key domain concept or vocabulary word such as *mineral.* Have them brainstorm everything that comes to mind when they hear the word, such as *diamond, salt,* etc. Record their responses on a piece of chart paper for reference.

Riddles for Core Content

Ask the students riddles such as the following to review core content:

- I work in a coal mine. Who am I? (miner)
- I am a type of rock made from lots of pressure on sediments for a very long time. What am I? (sedimentary rock)
- I am a type of rock made from magma or lava that has cooled and hardened. What am I? (igneous rock)
- I am a mineral that people often add to food as a seasoning. What am I? (salt)
- I am a sedimentary rock that people mine and use to make electricity. What am I? (coal)

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 the students brainstorm important information about the three types of rocks, minerals, and how rocks and minerals are taken from the earth. 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

Materials: Image Cards 1–3

Give three students the image cards for heat, pressure, and time. Review what the image cards represent. Have the three students stand in various locations around the room.

Tell the class that you are going to say a word. They will decide how heat, pressure, or time are connected to the word and then walk to and stand with the person holding that image card. After the students have walked to the various locations, have them explain how the two words are connected. For example, if you say the words *metamorphic rock,* one student may walk to the image card of heat and say, "Heat changes other rocks into metamorphic

rocks." A second student may walk to the image card of pressure and say, "Pressure changes other rocks into metamorphic rocks." A third student may walk to the image card of time and say, "It takes a long time for metamorphic rocks to be formed."

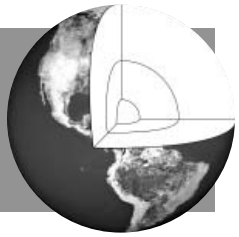
Another variation is to use the signals explained in the first Pausing Point.

Letter to a Geologist

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.

8 Fossils



Lesson Objectives

Core Content Objectives

Students will:

- Describe fossils
- Explain how fossils provide information about the history of the earth
- Describe how heat, pressure, and time cause many changes inside the earth
- Understand that much of our knowledge of the earth and its history is the result of the work of many scientists

Language Arts Objectives

Students will:

- Use agreed-upon rules for group discussions, i.e., look at and listen to the speaker, raise hand to speak, take turns, say "excuse me" or "please," etc. (L.1.1)
- Carry on and participate in a conversation over at least six turns, staying on topic, initiating comments or responding to a partner's comments, with either an adult or another child of the same age (L.1.3)
- Prior to listening to a read-aloud, identify (orally or in writing) what they know and have learned that may be related to the specific story or topic to be read aloud (L.1.10)
- Listen to and understand a variety of texts, including fictional stories, fairy tales, fables, historical narratives, informational text, nursery rhymes, and poems (L.1.11)

- Use pictures accompanying the read-aloud to check and support understanding of the read-aloud (L.1.14)
- Learn new words from read-alouds and discussions (L.1.15)
- Answer questions (orally or in writing) requiring literal recall and understanding of the details, and/or facts of a read-aloud, i.e., who, what, where, when, etc. (L.1.17)
- Ask questions to clarify information or the topic in a read-aloud (L.1.18)
- Answer questions that require making interpretations, judgments, or giving opinions about what is heard in a read-aloud, including answering "why" questions that require recognizing cause/effect relationships (L.1.20)
- With assistance, create and interpret timelines and lifelines related to read-alouds (L.1.23)
- Share writing with others (L.1.29)

Core Vocabulary

fossil, *n.* The print or remains preserved in rock of a plant or animal that died many years ago
Example: The scientists found a large fish fossil.
Variation(s): fossils

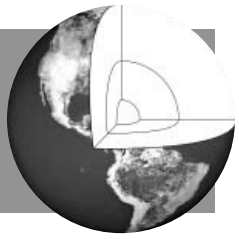
impression, *n.* A mark or shape left on a surface formed by pressure
Example: Their mother always knew when they jumped on the bed because of the impression their feet left on the mattress.
Variation(s): impressions

paleontologist, *n.* Someone who studies living things from long ago by looking at fossils
Example: As a paleontologist, she was able to travel to many different places to study fossils.
Variation(s): paleontologists

preserved, *v.* Kept in excellent condition; unchanged over time
Example: The cold temperature of the refrigerator preserved the fruits and vegetables.
Variation(s): preserve, preserves, preserving

At a Glance	Exercise	Materials	Minutes
Introducing the Read-Aloud	**What Have We Already Learned?**		10
	What Do We Know?		
	Purpose for Listening		
Presenting the Read-Aloud	**Fossils**		15
Discussing the Read-Aloud	**Comprehension Questions**		10
	Word Work: Preserved		5
 **Complete Remainder of the Lesson Later in the Day**			
Extensions	**Timeline**	Image Cards 10–13	20

8A Fossils



Introducing the Read-Aloud

***10** minutes*

What Have We Already Learned?

Ask the students if they remember what kind of scientist Gerry is. (geologist) Ask the students to share the things that Gerry the Geologist has taught them. (three types of rocks, various minerals, volcanoes, geysers, etc.) Tell the students that all of these things are not living; they are not plants or animals.

Explain that there are other scientists called paleontologists who study things that were living on the earth millions of years ago. Ask students to say the word *paleontologist* after you. Remind the students that plants and animals are living things.

What Do We Know?

Ask the students if they know of any plants or animals that lived on the earth millions of years ago.

Purpose for Listening

Tell the students to listen carefully to find out how paleontologists learn about things that lived on the earth millions of years ago.

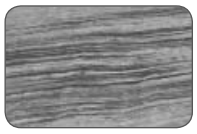
Presenting the Read-Aloud — **15** *minutes*

Fossils

Show image 8A-1: Pam the Paleontologist

Hi everyone. My name is Pam. Gerry the Geologist is a friend of mine. He called me up this morning and asked me to come in and finish teaching you about the history of the earth. He is sorry he can't be here, but all this rock-talk has him itching to do a little rock hunting himself, so he is off in the mountains somewhere with his rock hammer.

You may be wondering why I am standing here holding this bone. Well, I am a **paleontologist,** so you can call me Pam the Paleontologist. Can you say *paleontologist*? A paleontologist is a scientist who studies paleontology, which is the study of life that existed on earth in the distant past. This isn't just any bone: It's a dinosaur bone! I'll be teaching you about dinosaurs in the near future.



Show image 8A-2: Sedimentary rock [1]

Gerry told me that you already know about basic geologic factors: heat, pressure, and time. You also know how sedimentary rocks such as sandstone and limestone are formed. So, you know enough about geology and the history of the earth to begin learning about the history of *life* on the earth. That is my specialty as a paleontologist. [2]

1 What do you see in this picture?

2 So what do paleontologists study?

Show image 8A-3: Fossilized shell

To be a paleontologist, you need to know a lot about geology—that's why Gerry and I are such good friends. But paleontologists also know a lot about the study of living things. So, we paleontologists know about the study of rocks—geology—and the study of living things, which brings us to the subject of fossils.

Do you know what a fossil is? A **fossil** is the **preserved** body or imprint of a plant or animal that lived thousands, millions, or even billions of years ago. [3] Most, like this fossil of a seashell, show you where the body of an animal or plant died and was buried under

3 If something is preserved, it is kept in good condition over a long period of time.

layer after layer of sediment. Over millions of years, with more and more sediment pressing down on it, this shell became part of the stone that formed as a result of geologic pressure. But you are not seeing the actual shell. You are only seeing the **impression** of it.[4] The creature itself decayed and rotted away.

4 You are only seeing the shape of it.

Show image 8A-4: Fossil hunter

You know that if you dig down into the earth, you will discover that the soil and rocks are divided into layers. These layers represent different geologic periods, or times during which conditions in the crust and surface of the earth changed. For instance, if you find a layer of sandstone on dry land, then you know that there may have been an ocean or river over land at some point in the distant past. We can tell how old certain fossils are thanks to our understanding of geology and rock layers.

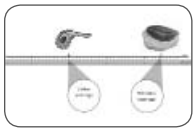
Fossils are usually found in layers of sedimentary rocks, though they can be found in other rock formations as well. It looks like the paleontologist in this picture has found a good place for fossil hunting, but you can see that fossils are not easy to find. He has to work pretty hard, digging and carefully breaking open rocks with a rock hammer.

Every fossil is part of the earth's fossil record. The fossil record is what paleontologists study in order to figure out what life on earth was like millions of years ago. Today, I would like to show you several different fossils from different time periods during the history of the earth.

Show image 8A-5: Trilobite

This is a fossil of a trilobite, an animal which lived about 550 million years ago. Trilobites may look like insects, but they are more closely related to lobsters and crabs. Trilobites came in many varieties, from a half-inch up to twenty-eight inches in length.[5] They had antennas, lots of legs, and a hard outer shell called an exoskeleton. That exoskeleton is important because it meant that dead trilobites were easily fossilized when they became buried in the sand.

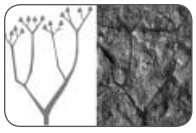
5 (Show these lengths with your hands.)



Show image 8A-6: Timeline

Working together and comparing rocks and fossils, geologists and paleontologists have managed to create an approximate timeline as to the ways in which life on earth has evolved from its simplest forms hundreds of millions of years ago through the present day.

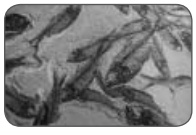
This timeline represents the entire history of the earth, starting 4.6 billion years ago on the far left. We are not yet certain when the first life forms appeared on the planet, but there is evidence that simple, germ-like organisms lived on earth over three billion years ago. So, the red dot represents the earliest life forms. The green dot represents the time at which trilobites appeared, 550 million years ago, or nearly all the way on the other side of the timeline.



Show image 8A-7: Cooksonia fossil

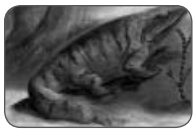
At about this same time, the fossil record shows that the first plants appeared on land. Back then, there was no soil on the land, because soil contains dead, decayed plants. Since these were the first plants on land, no plants had yet died in order to create soil. So, the first plants did not have the same characteristics as plants today. These plants were less than half an inch tall and they had no roots, leaves, flowers, or seeds, but they were plants nevertheless.[6]

6 (Show the height of less than half an inch with your hands.)



Show image 8A-8: Fish fossils

Soon came the Age of Fish. Fish ruled the waters, and there were lots of them, as this fossil suggests.

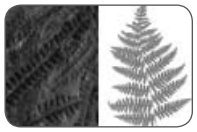


Show image 8A-9: Tetrapod recreation

Also during this time, plant and animal life on land began to spread rapidly. The first soils developed on land, allowing new types of plants with leaves, stems, and roots to grow. With new plants came new land creatures ready to eat those plants. Tetrapods, the first amphibians, made their way onto the beaches. An amphibian is an animal that lives part of its life in water and part on land, like a frog.

Paleontologists have found many tetrapod fossils, but I thought you would like to see this picture that an artist drew, which shows what a real tetrapod might have looked like. Do you think any of this tetrapod's body parts look like they belong to a fish?[7]

7 (Pause for students to answer.)



Show image 8A-10: Fern fossil

Then, lush forests full of trees and plants, such as ferns, began to grow.

Show image 8A-11: First reptiles

As forests increased, so too did the variety and sizes of animals. The first giant reptiles appeared. Of course, the one in this picture—called a dimetrodon—is just a model that someone made, but they based this model on fossilized dimetrodon bones that someone found. Paleontologists call that body part that sticks up on its back a sail because it kind of looks like the sail on a boat.

Dimetrodon was not a dinosaur, but it certainly looked like one, and dinosaurs were soon to follow. But we will have to wait until next time to learn more about them. That is as far as the fossil record will take us today.

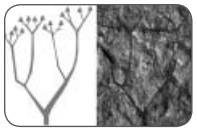
Discussing the Read-Aloud — *15 minutes*

Comprehension Questions — (10 minutes)

1. What do paleontologists like Pam study? (the history of life on the earth)
2. What is a fossil? (the preserved body or imprint of a plant or animal that lived long, long ago)
3. Are fossils formed over a short period of time or a very long period of time? (a very long period of time)

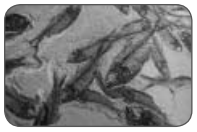
Show image 8A-5: Trilobite

4. What does this fossil tell us about the history of the earth? (Animals called trilobites lived long, long, long ago.)



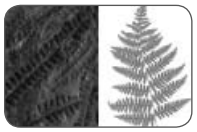
Show image 8A-7: Cooksonia fossil

5. What does this fossil tell us about the history of the earth? (Plants lived on the earth long, long ago that were quite different from plants today.)



Show image 8A-8: Fish fossils

6. What does this fossil tell us about the history of the earth? (Fish lived on the earth long, long ago.)



Show image 8A-10: Fern fossil

7. What does this fossil tell us about the history of the earth? (Ferns have lived on the earth for millions of years.)

8. *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.

Word Work: Preserved (5 minutes)

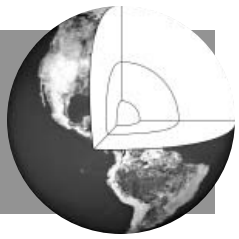
1. The read-aloud said, "A fossil is the *preserved* body or imprint of a plant or animal that lived thousands, millions, or even billions of years ago.
2. Say the word *preserved* with me.
3. If something is preserved, it is kept in good condition over time.
4. My mother preserved the pictures by putting them in a photo album.
5. Why is it important that things be preserved? Try to use the word *preserved* when you tell about it. (Ask two or three students. If necessary, guide and/or rephrase the students' responses: " _____ should be preserved because . . .")
6. What's the word we've been talking about?

Use a *Drawing/Writing* activity for follow-up. Directions: We often talk about how important it is that the earth be preserved for everyone to enjoy. For example, the oceans, the trees, and the rocks should be preserved. Choose one thing that you think should be preserved for everyone to enjoy. Draw a picture of it. Then, write a sentence about it, being sure to use the word *preserved*. Some students may need to dictate their sentence to an adult, while others may write independently.

Give the students the opportunity to share their drawings and writings with a partner or the entire class.

Complete Remainder of the Lesson Later in the Day

8B Fossils



Extensions

20 *minutes*

Timeline

On a sheet of chart paper, create a timeline similar to the one in image 8A-6.

Pass out Image Cards 10–13 to four groups of students. Tell the students that they are going to pretend to be paleontologists studying fossils to learn about life on the earth long, long ago. Have each group talk about their image card in the group and then come back together as a class to share.

First, have the "trilobite" group share what they know from the trilobite fossil (Image Card 10). Explain to the students that you are going to place the image card near the right end of the timeline because paleontologists believe that trilobites lived 550 million years ago.

Then, have the "Cooksonia" group share what they know from the Cooksonia fossil (Image Card 11). Explain to the students that paleontologists believe that Cooksonia lived on the earth at about the same time as trilobites so you are going to place the image card above the trilobite card to show that they lived at about the same time.

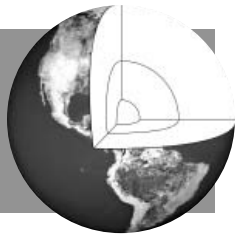
Next, have the "fish" group share what they know from the fish fossil (Image Card 12). Remind the students that paleontologists believe that fish lived long, long ago but after trilobites and Cooksonia. Ask the students where the fish image card should be placed on the timeline and then place it to the right of the trilobite and Cooksonia cards.

Finally, have the "fern" group share what they know from the fern fossil (Image Card 13). Remind the students that paleontologists believe that ferns lived on the earth long, long ago but after trilobites, Cooksonia, and fish. Ask the students where the fern

image card should be placed on the timeline, and then place it to the right of the fish image card.

Explain to the students that it is easy to look at the timeline and see the order in which these living things appeared on the earth. If time allows, you may have students use the timeline to answer questions such as, “Did fish first live on the earth before or after trilobites?”

9 Dinosaurs



Lesson Objectives

Core Content Objectives

Students will:

- Describe fossils
- Explain how we know about dinosaurs
- Describe various dinosaurs
- Explain how fossils provide information about the history of the earth
- Understand that much of our knowledge of the earth and its history is the result of the work of many scientists

Language Arts Objectives

Students will:

- Use agreed-upon rules for group discussions, i.e., look at and listen to the speaker, raise hand to speak, take turns, say "excuse me" or "please," etc. (L.1.1)
- Carry on and participate in a conversation over at least six turns, staying on topic, initiating comments or responding to a partner's comments, with either an adult or another child of the same age (L.1.3)
- Prior to listening to a read-aloud, identify (orally or in writing) what they know and have learned that may be related to the specific story or topic to be read aloud (L.1.10)
- Listen to and understand a variety of texts, including fictional stories, fairy tales, fables, historical narratives, informational text, nursery rhymes, and poems (L.1.11)

- Make predictions (orally or in writing) prior to and during a read-aloud, based on the title, pictures, and/or text heard thus far, and then compare the actual outcomes to predictions (L.1.12)
- Use pictures accompanying the read-aloud to check and support understanding of the read-aloud (L.1.14)
- Learn new words from read-alouds and discussions (L.1.15)
- Answer questions (orally or in writing) requiring literal recall and understanding of the details, and/or facts of a read-aloud, i.e., who, what, where, when, etc. (L.1.17)
- Answer questions that require making interpretations, judgments, or giving opinions about what is heard in a read-aloud, including answering "why" questions that require recognizing cause/effect relationships (L.1.20)
- Draw pictures, dictate, or write simple sentences to represent details or information from a read-aloud. (L.1.24)
- Share writing with others (L.1.29)

Core Vocabulary

debris, *n.* The scattered remains of an object that has been broken or destroyed
Example: Debris from the broken canoe floated downriver.
Variation(s): none

excavating, *v.* Removing or exposing something by digging
Example: Archaeologists and paleontologists have lots of experience excavating objects from long ago.
Variation(s): excavate, excavates, excavated

extinct, *adj.* No longer living or existing
Example: Dinosaurs are extinct.
Variation(s): none

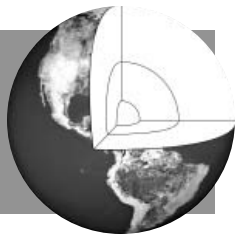
fossilized, *adj.* Made into a fossil
Example: The fossilized remains of dinosaur bones are often dug up and studied to learn about this ancient animal.
Variation(s): none

meteor, *n.* A piece of rock from space that usually burns up as it enters the earth's atmosphere
Example: The meteor left a bright trail as it streaked through the sky.
Variation(s): meteors

meteorite, *n.* A piece of rock that falls from space to the earth's surface
Example: A meteorite was found in the desert.
Variation(s): meteorites

At a Glance	Exercise	Materials	Minutes
Introducing the Read-Aloud	**What Have We Already Learned?**	timeline from previous lesson	10
	Making Predictions About the Read-Aloud		
	Purpose for Listening		
Presenting the Read-Aloud	**Dinosaurs**		15
Discussing the Read-Aloud	**Comprehension Questions**	Image Card 14 timeline from previous lesson	10
	Word Work: Extinct		5
Complete Remainder of the Lesson Later in the Day			
Extensions	**Domain-Related Trade Book**	trade book	20

9A Dinosaurs



Introducing the Read-Aloud

***10** minutes*

What Have We Already Learned?

Use the timeline created in the extension activity from Lesson 8 to review the history of living things on the earth. Review that a fossil can be either the preserved body or the imprint of a plant or animal that lived long, long ago. Explain that even though paleontologists are interested in the history of *life* on earth, they still need to know a lot about geology in order to date the fossils on the timeline. Remind students that the soil and rocks are divided into layers and that the layers represent different geologic times when changes happened to the crust of the earth. Make sure that students grasp that we determine how old certain fossils are thanks to our understanding of geology and rock layers. Talk about each image card on the timeline and the order in which these living things inhabited the earth.

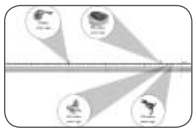
Making Predictions About the Read-Aloud

Tell the students that, in the next read-aloud, Pam the Paleontologist is going to teach them about dinosaurs. Ask the students to predict where dinosaurs fit on the timeline.

Purpose for Listening

Tell the students to listen carefully to find out whether or not their predictions are correct and to learn about dinosaurs.

Presenting the Read-Aloud — *15 minutes*



Dinosaurs

Show image 9A-1: Timeline

Hey there, fellow scientists! It's Pam the Paleontologist again. Last time I was here, I gave you a whirlwind tour of history right up through the time of the dimetrodons, those reptiles with the big sails on their backs. The age of the dimetrodons was followed by a time known as the Age of Reptiles. This era began approximately 245 million years ago.

Show image 9A-2: Tyrannosaurus Rex skeleton

I'll bet some of you know the name of the dinosaur in this picture.[1] It is a Tyrannosaurus Rex, or T. Rex as some people call it. It was one of the largest and most fearsome predators ever to walk the earth. We can tell by its teeth that the T. Rex was a meat eater. We also know that it was over forty feet long and up to twenty feet tall, and judging by the size of its bones, it weighed about seven tons, or more than two average-sized cars.

1 (Pause for students to answer.)

Show image 9A-3: T. Rex and Triceratops[2]

This painting shows T. Rex facing off against a triceratops, a dinosaur with long horns and a shield-like plate on its head. Keep in mind when you look at artwork like this that nobody today really knows what dinosaurs looked like. We have only seen their bones. So artists using information supplied by scientists today try to make good guesses about what they think dinosaurs looked like when they were alive, based on their bones. Many people think of dinosaurs as giant reptiles, and in fact the word *dinosaur* means "terrifying lizard." However, we paleontologists now believe that dinosaurs are more closely related to birds than they are to lizards. Whatever the case may be, there are no dinosaurs on earth anymore. They have all been **extinct**—dead and gone—for millions of years.[3] Now there are just fossilized bones of dinosaurs buried in the earth's crust.

2 How are these two dinosaurs alike, and how are they different?

3 So if something is extinct, is it still around today?

Show image 9A-4: Stegosaurus[4]

4 How would you describe this dinosaur?

Here is my personal favorite: the stegosaurus. Like the triceratops, the stegosaurus was a herbivore, or plant eater, but it had some pretty good ways of defending itself against the likes of T. Rex and other meat eaters. Stegosaurus had hard, sharp plates on its back, which would have made it difficult to bite, but just in case anyone tried, it also had a spiky tail that could really do some damage. This is a model someone made for a museum.

Show image 9A-5: Excavating dinosaur bones

So, how do we find and learn about these incredible beasts? Dinosaurs ruled the earth for over 100 million years, and their **fossilized** bones can be found in many parts of the world, including the United States.[5] But they are hard to find, and **excavating**—or digging up—their bones is not as easy as you might think.

5 *Fossilized* means that over a long period of time the bones have become like a fossil or rock.

Once paleontologists find an area that is likely to have dinosaur bones, we move in with our tools and begin careful excavation. It's not like mining or quarrying where you can just blast into the rock with dynamite or big drills. If you do that, then you will only damage the fossils. Instead, paleontologists must use sharp little knives and small brushes to gradually scrape away the sedimentary rock surrounding the fossils. It will take this paleontologist days and maybe even weeks to excavate this one bone. It's slow work, and some people would even find it boring, but to me there is nothing more exciting in the world than carefully uncovering a bone that's been buried in rock for 100 million years.[6]

6 Do you think it would be boring or exciting to excavate dinosaur bones?

Show image 9A-6: Large excavation

Here a paleontologist is excavating a large collection of bones from the sandstone cliffs of Dinosaur National Monument, an area located in the states of Colorado and Utah where we have uncovered hundreds and thousands of dinosaur bones. Wow! Some of those bones are bigger than the person working on them.

Can you see all the bones in this picture? That was one big dinosaur! But what did it really look like? It's hard to tell because, over time, the bones have moved around and become broken. As a paleontologist, I sometimes feel like I spend half my life putting puzzles together. Often we only find a few bones—the rest of the skeleton was long since destroyed or perhaps even dragged away by a predator millions of years ago. Other times, lots of different dinosaur bones can be mixed in together. So, we paleontologists have to use our detective skills to figure out which bones belonged to which type of dinosaur.

Show image 9A-7: Excavating Camarasaurus

In fact, those bones belonged to a mighty Camarasaurus. I knew as soon as I saw its head. This plant eater was sixty feet long and weighed about twenty tons. A real whopper!

Show image 9A-8: Camarasaurus illustration

Here is one artist's idea of what the Camarasaurus looked like. It could use its long tail to fend off predators. Good thing you don't have to worry about these things in the ocean anymore!

Show image 9A-9: Compsognathus[7]

Not all dinosaurs were huge. In fact, some were really small. Take the compsognathus. This little critter stood just two feet tall and scurried around on two little bird-like legs. And believe it or not, compsognathus was a meat eater. It fed on little lizards. How do I know that? Because we found parts of fossilized lizard in the stomach cavity of a compsognathus fossil, that's how!

7 How would you describe this dinosaur?

Show image 9A-10: Tyrannosaurus Rex skeleton

So, what happened to the dinosaurs? Why can't you go and see a live T. Rex today at the zoo? Dinosaurs are extinct; they all died about 65 million years ago. According to fossil records, the extinction of the dinosaurs was quite sudden. Why? That's something paleontologists have been trying to answer ever since the first dinosaur bones were discovered and identified nearly two hundred years ago.

Show image 9A-11: Meteor

For years, many scientists believed that extraordinary geologic events, such as super volcanoes, must have had something to do with it. These days, however, scientists believe that the dinosaur extinction was caused by a giant **meteorite** from outer space.[8] There are billions of rocks or meteors out there: Some meteors are quite large, but most are tiny, between the size of a sand grain and a baseball. Meteors are whizzing around all over the place in outer space. Occasionally, a **meteor** crashes toward Earth. When this happens, the meteor hits the atmosphere at an incredible speed and usually burns up as it enters the uppermost parts of earth's atmosphere.[9] Occasionally, bits and pieces of meteors survive their trip through the atmosphere and actually fall to earth. This is very rare, but it does happen from time to time, and it is possible to find pieces of them on the ground. When part of a meteor survives the trip through the atmosphere and lands on Earth, the meteor becomes a meteorite, or space rock.

8 A meteorite is a piece of rock that falls from space to the earth.

9 (If you have already studied the *Astronomy* domain, remind students that this creates a streak of light in the night sky that some people think is a shooting star.)

Show image 9A-12: Recovered meteorite

Now, let's go back to dinosaur extinction. Some scientists think that the dinosaur extinction was caused by a giant meteorite from outer space. When the meteorite struck the earth, it sent massive plumes of **debris** up into the atmosphere.[10] This debris would have blocked out the light and energy of the sun, causing much of the earth's plant life to die and severely lowering the temperature. Most creatures at the time were unable to adapt and they died out before the skies had a chance to clear.

10 It sent large amounts of bits and pieces of objects from the earth up into the atmosphere.

Whether this is true or not remains to be seen, though geologists have discovered at least one very large crater that was caused by a meteorite impact about the time the dinosaurs became extinct. Whatever the case, we know that dinosaurs became extinct, making way for new kinds of life on earth. I, for one, will continue to study the earth's fossil record, and I am sure we will find the answer some day, because the clues about the

history of the earth are all there in the rocks. Ask my friend Gerry the Geologist and he will tell you the same thing!

Discussing the Read-Aloud *15 minutes*

Comprehension Questions (10 minutes)

1. Were your predictions correct? Why or why not? (Answers may vary.) [Note to Teacher: Add Image Card 14 (dinosaur) to the timeline to show that dinosaurs lived later than the other plants and animals shown on the timeline.]

Show image 9A-2: Tyrannosaurus Rex skeleton

2. Do you remember the name of this dinosaur? (Tyrannosaurus Rex) Pretend that you are a paleontologist. How would you describe a Tyrannosaurus Rex to someone? (meat eater, very large, predator, etc.)

3. What does it mean when someone says that dinosaurs are extinct? (There are no living dinosaurs.)

Show image 9A-4: Stegosaurus

4. Do you remember the name of this dinosaur? (Stegosaurus) Pretend that you are a paleontologist. How would you describe a Stegosaurus to someone? (plant eater, sharp plates on its back, spiky tail, etc.)

5. Do we know what dinosaurs really looked like? (no) Why not? (They lived millions of years ago and only their bones have been found; they are extinct.)

6. How do we know anything about dinosaurs if they are extinct? (Paleontologists have found and studied fossilized bones.)

7. What do some scientists think caused dinosaurs to become extinct? (a meteorite) Do you think scientists will ever be sure? (Answers may vary.)

I am going to ask a question. I will give you a minute to think about the question, and then I will ask you to turn to your neighbor and discuss the question. Finally, I will call on several of you to share what you discussed with your partner.

8. *Think Pair Share:* What would it be like to find a dinosaur bone? (Answers may vary.)

Word Work: Extinct (5 minutes)

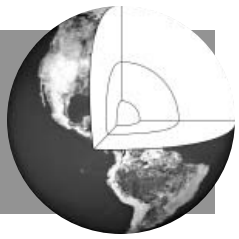
1. The read-aloud said, "[Dinosaurs] have all been *extinct*—dead and gone—for millions of years."
2. Say the word *extinct* with me.
3. If a plant or an animal is extinct, there are none left or living.
4. Some animals are protected so that they don't become extinct.
5. Are there some animals that you are afraid are in danger of becoming extinct? What animals do you hope never become extinct? Try to use the word *extinct* when you tell about it. (Ask two or three students. If necessary, guide and/or rephrase the students' responses: "I hope _____ never become extinct.")
6. What's the word we've been talking about?

Use a *Drawing/Writing* activity for follow-up. Directions: Think about the dinosaurs you heard about in the read-aloud. Draw a picture of at least one of them. Then write a sentence telling that dinosaurs are extinct.

Some students may need to dictate their sentences to an adult while others may write their sentences independently. Give students the opportunity to share their drawings and writings with a partner or the entire class.

Complete Remainder of the Lesson Later in the Day

9B Dinosaurs



Extensions

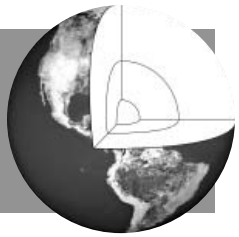
***20** minutes*

Domain-Related Trade Book

Refer to the list of recommended trade books in the domain introduction at the front of this teacher's guide, and choose one about dinosaurs to read aloud to the class. As you read, use the same strategies that you have been using when reading the read-aloud selections in this anthology—pause and ask occasional questions; rapidly clarify critical vocabulary within the context of the read-aloud; etc. After you finish reading the trade book aloud, lead students in a discussion as to how the story or information in this book relates to the read-alouds in this domain. Discuss whether the trade book was fiction or nonfiction, fantasy or reality, historical or contemporary.

You may also ask students to write about the most interesting thing they learned from the trade book. You may suggest how to begin the sentence by writing on the board, "The most interesting thing that I learned was . . ."

10 The Fossils of La Brea Tarpits



Lesson Objectives

Core Content Objectives

Students will:

- Explain how fossils provide information about the history of the earth
- Explain the significance of the La Brea Tar Pits
- Describe how heat, pressure, and time cause many changes inside the earth
- Understand that much of our knowledge of the earth and its history is the result of the work of many scientists

Language Arts Objectives

Students will:

- Use agreed-upon rules for group discussions, i.e., look at and listen to the speaker, raise hand to speak, take turns, say "excuse me" or "please," etc. (L.1.1)
- Carry on and participate in a conversation over at least six turns, staying on topic, initiating comments or responding to a partner's comments, with either an adult or another child of the same age (L.1.3)
- Prior to listening to a read-aloud, identify (orally or in writing) what they know and have learned that may be related to the specific story or topic to be read aloud (L.1.10)
- Listen to and understand a variety of texts, including fictional stories, fairy tales, fables, historical narratives, informational text, nursery rhymes, and poems (L.1.11)

- Use pictures accompanying the read-aloud to check and support understanding of the read-aloud (L.1.14)
- Learn new words from read-alouds and discussions (L.1.15)
- Answer questions (orally or in writing) requiring literal recall and understanding of the details, and/or facts of a read-aloud, i.e., who, what, where, when, etc. (L.1.17)
- Ask questions to clarify information or the topic in a read-aloud (L.1.18)
- Answer questions that require making interpretations, judgments, or giving opinions about what is heard in a read-aloud, including answering "why" questions that require recognizing cause/effect relationships (L.1.20)
- With assistance, create and interpret timelines and lifelines related to read-alouds (L.1.23)
- Evaluate and select read-alouds, books, or poems on the basis of personal choice for rereading (L.1.27)

Core Vocabulary

ice age, *n.* A cold period where large parts of the earth are covered by glaciers and ice
Example: Many animals that existed in the most recent ice age are now extinct.
Variation(s): none

mammoth, *n.* A large, extinct, hairy elephant
Example: A mammoth, like an elephant today, would travel with its family or herd.
Variation(s): mammoths

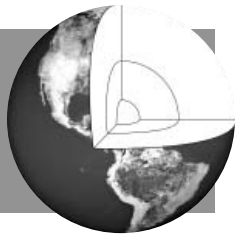
petroleum, *n.* A natural liquid made from the remains of plants
Example: Petroleum can be made into gasoline, fuel, or asphalt.
Variation(s): none

pits, *n.* Deep holes in the ground
Example: The uprooted trees left large pits in the ground.
Variation(s): pit

tar, *n.* A dark, thick, sticky liquid made from coal or wood
Example: The workers spread the tar across the ground to make a road.
Variation(s): none

At a Glance	Exercise	Materials	Minutes
Introducing the Read-Aloud	**What Have We Already Learned?**		10
	Purpose for Listening		
Presenting the Read-Aloud	**The Fossils of La Brea Tar Pits**	U.S. map	15
Discussing the Read-Aloud	**Comprehension Questions**		10
	Word Work: Pits		5
 **Complete Remainder of the Lesson Later in the Day**			
Extensions	**Timeline**	Image Cards 10–15 timeline	20
	Student Choice		

10A The Fossils of La Brea Tarpits



Introducing the Read-Aloud

***10** minutes*

What Have We Already Learned?

Ask the students how scientists have learned about the history of the earth. (rocks, fossils, dinosaur bones) Tell the students that the next read-aloud is about a very interesting place called the La Brea Tar Pits that gave scientists much information about the history of the earth.

Purpose for Listening

Tell the students to listen carefully to find out about the La Brea Tar Pits and what this place told scientists about the history of the earth.

Presenting the Read-Aloud — **15** *minutes*

The Fossils of La Brea Tar Pits

Show image 10A-1: Pam the Paleontologist

Pam the Paleontologist back to give you one last lesson about the history of the earth! I have already taught you about how every fossil is part of the earth's fossil record. The fossil record is what my fellow paleontologists and I study in order to figure out what life on earth was like millions of years ago. Today, I would like to tell you about a special place called La Brea. Thanks to the fossils found there, paleontologists have been able to learn a whole lot more about the history of life on the earth.

Show image 10A-2: Los Angeles

This is a photo of the city of Los Angeles, which is in the state of California.[1] Today, it is one of the largest cities in the country, home to millions of people from all over the world.

1 (Show on a map of the U.S.)

Show image 10A-3: La Brea Tar Pits

This picture was taken in an area just outside Los Angeles, in a place called La Brea, in the year 1910. Today, practically everything you see here is literally buried beneath the city of Los Angeles. Back then, however, it was an oil field—a place where people dug wells to pump petroleum up out of the ground. **Petroleum** is used to make gasoline, which millions of people all over the world pump into their gas tanks every day at gas stations to power their cars. Petroleum is a dark, thick, natural liquid that forms underground.

Normally, you need to know a lot about geology in order to know where to look for petroleum. Normally, petroleum is not easy to find, and you never know if it's really there until you drill way down into the ground and find it.

Show image 10A-4: Tar pit

However, it did not take a great geologist to discover that there was oil in La Brea, California. That is because, deep underground, there are cracks in the bedrock that allow hot crude oil to seep up and gather in pools on the surface. Once exposed to sunlight on the surface, the lighter parts of the crude oil evaporated into the air, leaving deep, heavy, gooey **pits** of black **tar.** [2]

2 Pits of tar are deep holes filled with a thick, sticky liquid.

A hundred years ago, these warm, bubbly pits were a good clue that there was crude oil underground. People living near these tar pits soon found that this sticky tar was great for gluing shingles onto the roofs of houses. In fact, local Native Americans had been using the tar to build their homes for thousands of years.

Show image 10A-5: Mammoth sculptures at La Brea

But that's not all there was to learn about the history of the earth in La Brea, California!

Do you recognize the creature in this photo? [3] At first glance, you might think it is an elephant. In fact, it is an ancient ancestor of the modern elephants you see at the zoo or in parts of Africa and Asia. But this is no ordinary elephant! This is a **mammoth;** among other important differences, the mammoth's body and tusks are larger than modern elephants. Moreover, mammoths are extinct. [4] We believe that the last ones died off ten or twenty thousand years ago.

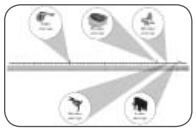
3 (Pause for students to respond.)

4 Do you remember what the word *extinct* means?

So you are probably wondering how I got a picture of these mammoths. Well, the mammoths in this picture are actually fake! They are just sculptures, or models, found at La Brea Tar Pits museum in California, but they provide a clue as to why La Brea is so important for paleontologists.

Show image 10A-6: Fossil hunter

It turns out that lots of animals were drawn to the tar pits because they looked like puddles of water. Paleontologists found many bones of several prehistoric animals in this area that have helped us continue the fossil record I told you about.



Show image 10A-7: Timeline

We covered everything from trilobites to T. Rex.[5] Today we will follow the fossil record just about as far as it can possibly go, all the way to the right edge of the timeline, two million years ago, at the beginning of the last **ice age.**[6]

5 Which lived first on the earth: trilobites or T. Rex?

6 An ice age is a period of time when much of the earth is covered by ice.

Show image 10A-8: Prehistoric scene at La Brea Tar Pits

Imagine stumbling across a scene like this out in the wilderness today! That can't happen, but this may have been a normal scene as recently as twenty or thirty thousand years ago.

The animal on the ground on the left-hand side of the painting is a saber-tooth tiger.[7] The animal on the right-hand side of this painting is called a giant ground sloth. If you look closely you can see elephant-like mastodons and even a bison or two in the background.

7 (Point out the various animals in the image.)

Paleontologists have discovered fossil remains from every one of these animals in the La Brea Tar Pits, along with many, many others.

Show image 10A-9: Saber-toothed cat

Let's take a closer look at the famous saber-toothed cat, known to us paleontologists as smilodon. A saber is a sword, so you can probably guess where this cat got its name.

The saber-toothed cat is perhaps the most famous "ice age" cat, but paleontologists at La Brea have found bones from many other big cats that lived during the same time, including those of the extinct American Lion, which looked a lot like the "king of the jungle" you find in zoos or in Africa today.

Show image 10A-10: Mastodons

Take a closer look at this elephant-like mastodon, a close relative of the mammoth, but not quite the same. It is a bit smaller, a bit less furry, and its back is flatter. This is another animal that would have lived in this area during the ice age.

Show image 10A-11: Ice sheet

So, why do I keep talking about the ice age? Where's the ice?

Beginning roughly two million years ago, the earth began what is known as an "ice age," during which time the temperature on earth was much lower than it is today. Nearly one-third of the surface was covered in huge sheets of ice called glaciers.

But not all of the earth was covered in ice during the ice age. The farther you got from the poles and the closer you moved toward the equator, the warmer it was.[8] However, it was at least a little colder everywhere during the ice age compared to today. Los Angeles, and the La Brea area, for instance, would have been much cooler and wetter than today, with snowy winters and gushing rivers flowing down from the northern glaciers.

8 Who remembers where the North Pole, South Pole, and equator are located?

Show image 10A-12: Prehistoric scene at La Brea Tar Pits

This is the type of climate the animals whose fossils were found in the La Brea Tar Pits in southern California would have enjoyed during the ice age. Thanks to the fossils in the La Brea Tar Pits, paleontologists have been able to learn more about the history of the earth.

Show image 10A-13: Pam the Paleontologist

That's all the time I have to spend with you, but I hope you will continue to try to learn more about the history of the earth. Maybe one day you'll become a paleontologist or geologist and discover new things about the history of the earth.

Discussing the Read-Aloud **15** *minutes*

Comprehension Questions **(10** minutes**)**

1. What are the La Brea Tar Pits? (pits of sticky tar in California where petroleum was found)
2. How did the La Brea Tar Pits help paleontologists learn about the history of the earth? (Many fossils were found there.)

Show image 10A-5: Mammoth sculptures at La Brea

3. Do you remember the name of this animal? (mammoth) What did paleontologists learn about this animal from the La Brea Tar Pits? (similar to elephant, extinct)

Show image 10A-10: Mastodons

4. Do you remember the name of this animal? (mastodon) What did paleontologists learn about this animal from the La Brea Tar Pits? (similar to mammoth, but smaller and less furry, extinct)
5. What is an ice age? (a time when the earth was much colder and much of it was covered with ice)

Show image 10A-8: Prehistoric scene at La Brea Tar Pits

6. Describe what you see in this illustration. (saber-tooth tiger, sloth, mastodons, bisons) Is this a scene from long, long ago or a scene from modern times? (long, long ago) How do you know? (Some of these animals are extinct.)
7. *Where? 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 *where.* For example, you could ask, "Where does today's read-aloud take place?" Turn to your neighbor and ask your "where" question. Listen to your neighbor's response. Then your neighbor will ask a new "where" question, and you will get a chance to respond. I will call on several of you to share your questions with the class.

Word Work: Pits (5 minutes)

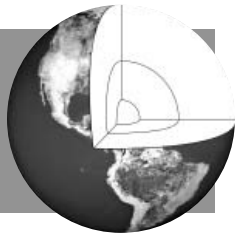
1. The read-aloud said, "Once exposed to sunlight on the surface, the lighter parts of the crude oil evaporated into the air, leaving deep, heavy, gooey *pits* of black tar."
2. Say the word *pits* with me.
3. Pits are deep holes in the ground.
4. Trash from our community is put into huge pits and then buried.
5. What else might be put into pits? Try to use the word *pits* when you tell about it. (Ask two or three students. If necessary, guide and/or rephrase the students' responses: "_____ might be put into pits.")
6. What's the word we've been talking about?

Use a *Questioning* activity for follow-up. Directions: I will ask a question about pits. You will think about how to answer the question. Be sure to use the word *pits* in your answer. (Answers may vary for all.)

1. Where might you find pits?
2. Would you like for there to be pits in the playground? Why or why not?
3. Do you think rocks might be found in pits? Why or why not?
4. What else might be found in pits?
5. What are some reasons people might dig pits?

Complete Remainder of the Lesson Later in the Day

10B The Fossils of La Brea Tarpits



Extensions

20 minutes

Timeline

Use the timeline created in the extension activity for Lesson 8, and added to in Lesson 9, to review the history of living things on the earth. Talk about each image card on the timeline and the order in which these living things inhabited the earth. Tell the students that you have an image card of animals whose fossils were found in the La Brea Tar Pits to add to the timeline (Image Card 15). Ask the students where it should go on the timeline. You may need to explain that the image card should go to the right of the dinosaurs because the ice age came after the time of the dinosaurs.

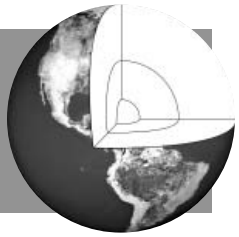
Student Choice

Ask the students which read-aloud they have heard recently that they would like to hear again. If necessary, reread the titles of recent read-alouds to refresh the students' memories. You may also want to choose one yourself.

Reread the text that is selected. Feel free to pause at different places in the read-aloud this time and talk about vocabulary and information that you did not discuss previously during the read-aloud.

After the read-aloud, ask students if they noticed anything new or different during the second reading that they did not notice during the first reading. Also, ask them to try to express why they like this read-aloud. Remember to repeat and expand upon each response using richer and more complex language, including, if possible, any read-aloud vocabulary.

PP3 Pausing Point 3



Note to Teacher

This is the end of the read-alouds that focus on fossils and prehistoric animals. You may choose to pause here and spend one to two days reviewing, reinforcing, or extending the material taught thus far.

If you do pause, you may have students do any combination of the activities listed below. The activities may be done in any order. You may wish to do one activity on successive days. 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:

- Describe fossils
- Explain how we know about dinosaurs
- Explain how rocks and fossils provide information about the history of the earth
- Explain the significance of the La Brea Tar Pits
- Describe how heat, pressure, and time cause many changes inside the earth
- Understand that much of our knowledge of the earth and its history is the result of the work of many scientists through the years

Activities

Image Review

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

Image Card Review

Materials: Image Cards 10–15

Divide the class into six groups. Give each group one of the image cards. Give the groups a few minutes to brainstorm everything they remember about the image card. Then come together as a class and give each group a chance to share.

Domain-Related Trade Book or Student Choice

Materials: Trade book

Read an additional trade book to review fossils or dinosaurs; refer to the books listed in the domain introduction. You may also choose to have the students select a read-aloud to be heard again.

Fossils

Have students create their own fossils. This can be done very simply with clay. You may also find directions on various websites for more sophisticated projects.

Be sure to talk about what fossils are, how they are formed, and what information they give.

You Were There: La Brea Tar Pits

Have students pretend that they were a paleontologist at the La Brea Tar Pits. Ask students to describe what they saw and heard. For example, students may talk about seeing fossils of a mammoth, a mastodon, etc. They may talk about hearing sounds from the city nearby. 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 La Brea Tar Pits.

Key Vocabulary Brainstorming

Materials: Chart paper

Give the students a key domain concept or vocabulary word such as *fossil.* Have them brainstorm everything that comes to mind when they hear the word, such as *trilobite, dinosaur bones,* etc. Record their responses on a piece of chart paper for reference.

Riddles for Core Content

Ask the students riddles such as the following to review core content:

- I am extinct but scientists believe that I lived millions of years ago because of my fossilized bones that have been found. What am I? (dinosaur, mastodon, mammoth, etc.)
- I study plants and animals that lived on the earth long, long ago. Who am I? (paleontologist)
- I am the preserved body or imprint of a plant or animal that lived in the distant past. What am I? (fossil)
- I am a place in California where the fossils of many animals were found. What am I? (La Brea Tar Pits)

Class Book: The History of the Earth

Materials: Drawing paper and drawing tools for each student

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 in this domain. Have the students brainstorm important information about fossils, dinosaurs, paleontologists, and the La Brea Tar Pits. 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.

Heat, Pressure, and Time

Materials: Image Cards 1–3

Give three students the image cards for heat, pressure, and time. Review what the image cards represent. Have the three students stand in various locations around the room.

Tell the class that you are going to say a word. They will decide how heat, pressure, or time are connected to the word and then walk to and stand with the person holding that image card. After the students have walked to the various locations, have them explain how the two words are connected. For example, if you say the word *fossil,* one student may walk to the image card of "pressure" and say, "It takes pressure to form a fossil." A second student may walk to the image card of "time" and say, "It takes a very long time for a fossil to form."

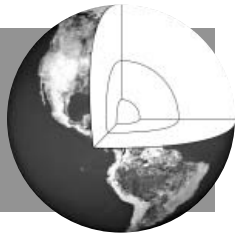
Another variation is to use the signals explained in the first Pausing Point.

Letter to a Paleontologist

As a class, brainstorm ideas and then write a letter to Pam or a real paleontologist. The students may talk about the cool things that paleontologists 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.

DA Domain Assessment



This domain assesment evaluates each student's retention of the core content targeted in *The History of the Earth.*

10 Domain Assessment (Instructional Master DA-1)

Note to Teacher: You may want to do the various parts of the assessment in more than one sitting. For Part I, you may choose to ask students to number a paper and write 'T' or 'F' beside each number rather than using the instructional master.

Part I (Instructional Master DA-1)

Directions: You have learned much about the history of the earth. I will read a sentence about the earth. If the sentence is true, you will circle the 'T.' If the sentence is not true, or false, you will circle the 'F.'

1. The earth's surface is covered by continents and oceans. (T)
2. The equator is an imaginary line that runs from the North Pole to the South Pole. (F)
3. The earth is shaped like a sphere or a ball. (T)
4. We know about the history of the earth because of the work of many scientists who study rocks and fossils. (T)
5. Heat, pressure, and time cause many changes inside the earth. (T)
6. The earth has two layers: the crust and the core. (F)
7. We live on the core of the earth. (F)
8. A volcano is caused by an eruption of magma making its way to the surface of the earth. (T)
9. A geyser is an eruption of lava. (F)
10. Salt is an important mineral that is used by people. (T)

11. All rocks can be put into three groups: igneous, sedimentary, and metamorphic. (T)
12. We know that dinosaurs lived on the earth because of fossilized bones that have been found. (T)
13. Rocks and minerals are sometimes taken from mines and quarries. (T)
14. Fossils are pieces of rock that come from the eruption of a geyser. (F)
15. Many fossils were found in the La Brea Tar Pits in California. (T)

Part II (Instructional Master DA-2)

Directions: Label the layers of the earth. Use 'C' for crust, 'M' for mantle, 'OC' for outer core, and 'IC' for inner core.

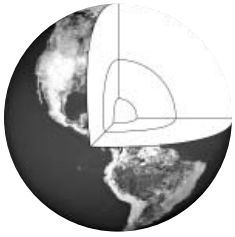
Part III (Instructional Master DA-3)

Directions: Label the North Pole, the South Pole, and the equator on the globe. Use 'N' for North Pole, 'S' for South Pole, and 'E' for equator.

On the back of the paper, draw a picture of and write a sentence about the most interesting thing that you learned about the history of the earth.

For Teacher Reference Only:

Copies of *Tell It Again! Workbook*



1B-1

Dear Parent or Guardian,

During the next several days, your child will be learning about the history of the earth. S/he will learn about the earth's surface, the layers of the earth (crust, mantle, and core), as well as volcanoes and geysers. Below are some suggestions for activities that you may do at home to reinforce what your child is learning about this science topic.

1. The Earth's Surface

Use a globe or map to help your child locate and identify the earth's continents and oceans. Also locate the North Pole, the South Pole, and the equator. Share with each other any knowledge that you have of these.

2. Make a Model

Make a model of the earth's layers or a volcano.

3. Draw and Write

Have your child draw and/or write about what has been learned about the layers of the earth, volcanoes, or geysers, and then share the drawing with you. Ask questions to keep your child using the vocabulary learned at school.

4. If You Were There

With your child, imagine what it would be like to witness a volcanic eruption. Talk about what you would see and hear and how you would feel.

5. Borrow a Book

Reading to your child is the single most important thing that you can do to encourage his/her literacy development. The local library has a variety of books on geology. Check one out and read it with your child.

Be sure to praise your child whenever s/he shares what has been learned at school.

2B-1

Name _____

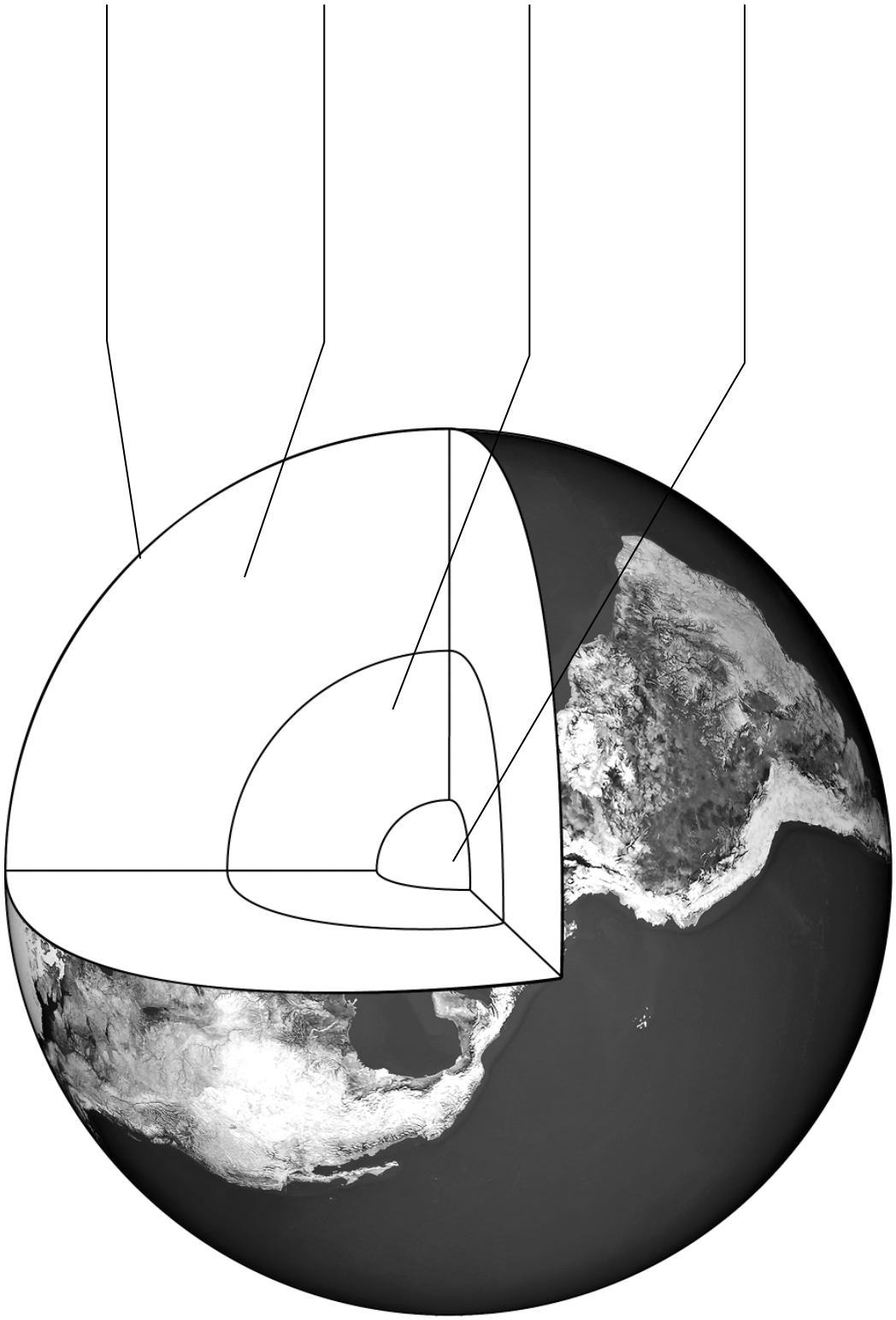
Directions: In the first column, draw pictures of or write about things that are found above the crust of the earth. In the second column, draw or write about things that are found on the crust of the earth. In the last column, draw or write about things that are found in the crust of the earth.

above the crust	on the crust	in the crust

3B-1

Name _____

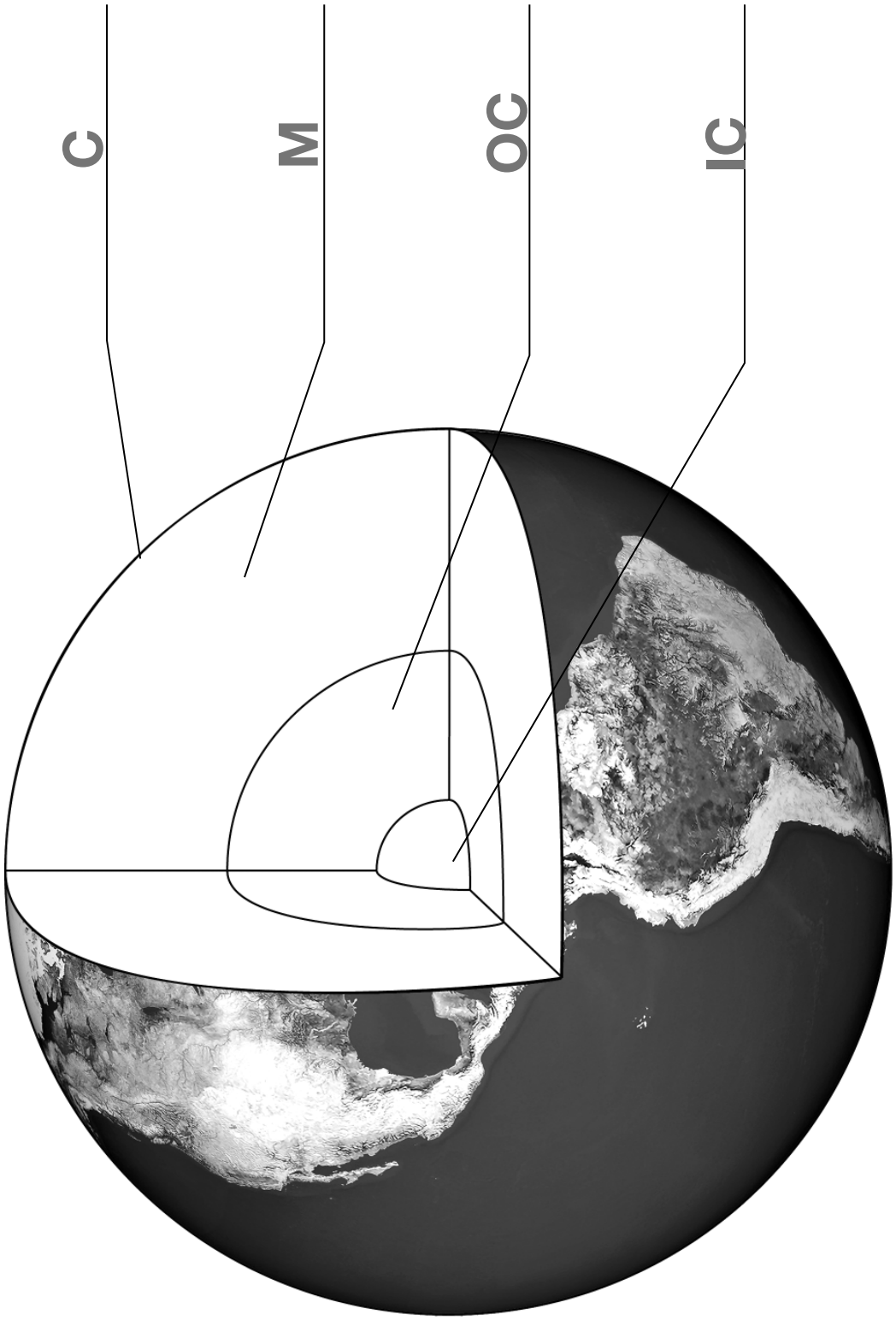
Directions: Point to and name each layer with the teacher. Label the layers using 'C' for crust, 'M' for mantle, 'OC' for outer core, and 'IC' for inner core, Then color the crust brown, the mantle red, the outer core orange, and the inner core yellow. On the back of the paper, write a sentence about each layer, being sure to use the words crust, mantle, outer core, and inner core in your sentences.



3B-1

Name **Answer Key**

Directions: Point to and name each layer with the teacher. Label the layers using 'C' for crust, 'M' for mantle, 'OC' for outer core, and 'IC' for inner core, Then color the crust brown, the mantle red, the outer core orange, and the inner core yellow. On the back of the paper, write a sentence about each layer, being sure to use the words crust, mantle, outer core, and inner core in your sentences.

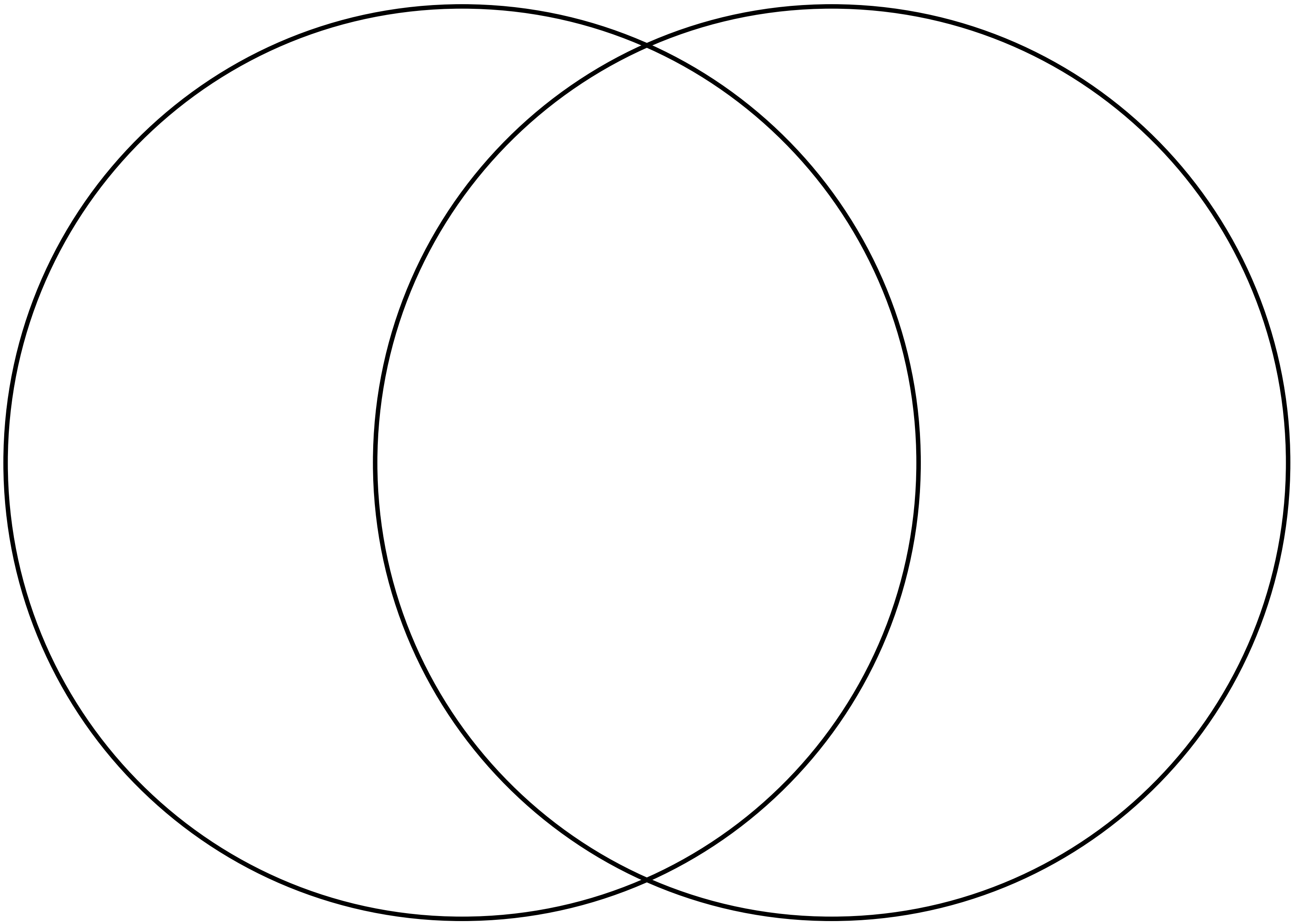


4B-1

Name ______________________________

Directions: Think about how volcanoes and geysers are similar and how they are different. Draw or write how they are alike in the overlapping part of the two circles. Draw or write how volcanoes are different from geysers in the circle labeled Volcano. Draw or write how geysers are different from volcanoes in the circle labeled Geyser.

Geyser Volcano



5B-1

Dear Parent or Guardian,

I hope you and your child have been enjoying talking about the history of the earth. Today your child learned about minerals and how they are useful to people. Soon, s/he will learn that all rocks can be sorted into three groups: igneous, sedimentary, and metamorphic. S/he will also learn about fossils and what they tell us about life on the earth millions of years ago. Below are some suggestions for activities that you may do at home to reinforce what your child is learning about this science topic.

1. Rock Collecting

If possible, have your child collect some rocks from nature and talk about their characteristics. If you do not have access to real rocks, look for pictures of rocks that can be described.

2. Draw and Write

Have your child draw and/or write about what has been learned about minerals, the three types of rocks, fossils, or dinosaurs and then share the drawing with you. Ask questions to keep your child using the vocabulary learned at school.

3. If You Were There

With your child, imagine what it would be like to discover a fossil or work in a mine. Talk about what you would see and hear and how you would feel.

4. Minerals

Talk about the ways that minerals such as coal or salt are important to you or other people.

5. Borrow a Book

Reading to your child is the single most important thing that you can do to encourage his/her literacy development. The local library has a variety of books on the history of the earth. Check one out and read it with your child.

Be sure to praise your child whenever s/he shares what has been learned at school.

6B-1

Name _____

Directions: In the first column, draw pictures of and/or write about igneous rocks. In the second column, draw and/or write about sedimentary rocks. In the last column, draw and/or write about metamorphic rocks.

igneous	sedimentary	metamorphic

DA-1

Name _____

Directions: Listen to the sentence read by the teacher. Circle the 'T' if the sentence is true. Circle the 'F' if the sentence is false.

1.	T	F
2.	T	F
3.	T	F
4.	T	F
5.	T	F
6.	T	F
7.	T	F
8.	T	F

9.	T	F
10.	T	F
11.	T	F
12.	T	F
13.	T	F
14.	T	F
15.	T	F

DA-1

Name **Answer Key**

Directions: Listen to the sentence read by the teacher. Circle the 'T' if the sentence is true. Circle the 'F' if the sentence is false.

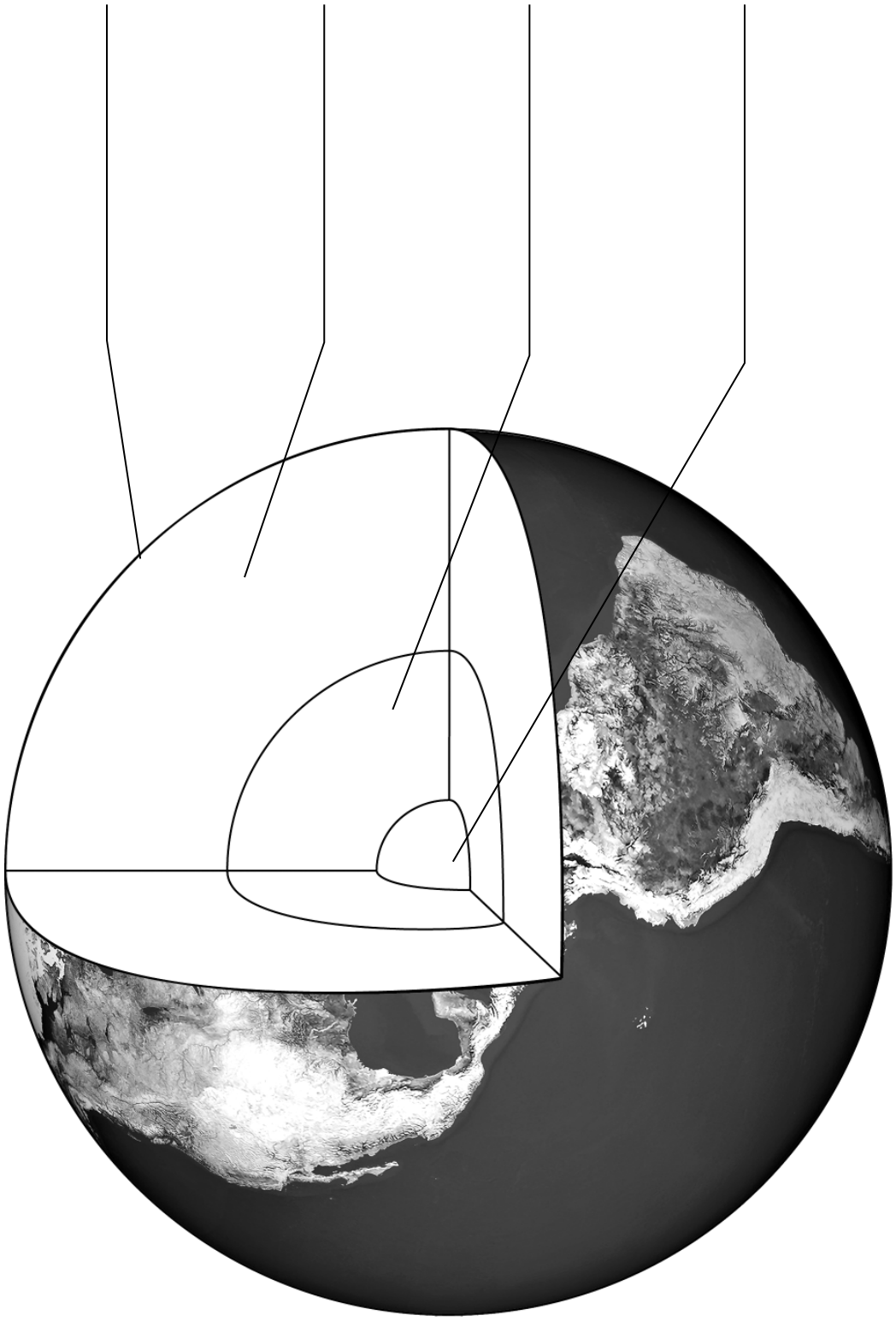
1.	(T)	F
2.	T	(F)
3.	(T)	F
4.	(T)	F
5.	(T)	F
6.	T	(F)
7.	T	(F)
8.	(T)	F

9.	T	(F)
10.	(T)	F
11.	(T)	F
12.	(T)	F
13.	(T)	F
14.	T	(F)
15.	(T)	F

DA-2

Name _____

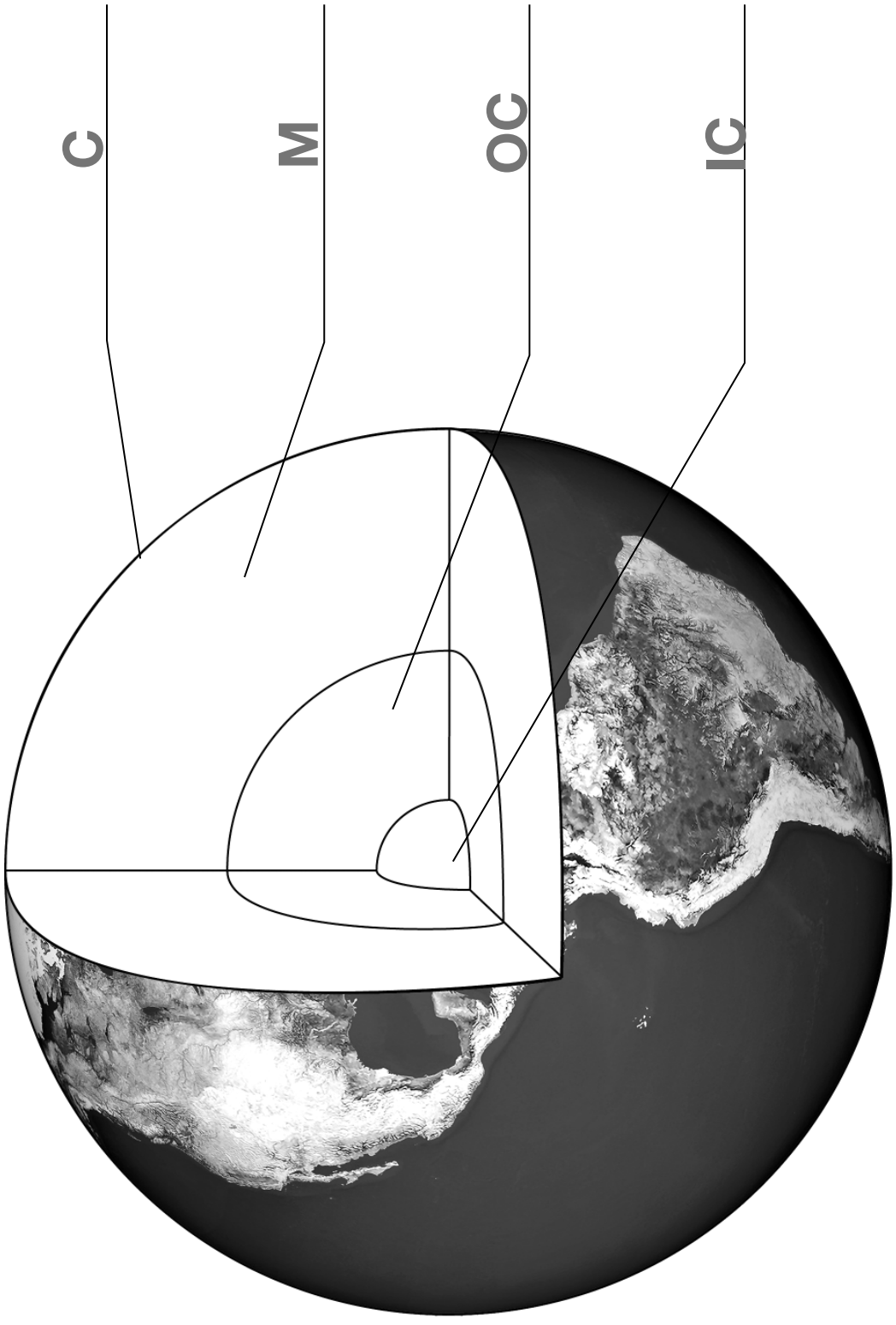
Directions: Label the layers using 'C' for crust, 'M' for mantle, 'OC' for outer core, and 'IC' for inner core.



DA-2

Name **Answer Key**

Directions: Label the layers using 'C' for crust, 'M' for mantle, 'OC' for outer core, and 'IC' for inner core.



DA-3

Name _____

Directions: Label the North Pole with 'N' and the South Pole with 'S.' Label the equator with 'E.' On the back of the paper, draw a picture of and write a sentence about the most interesting thing you learned about the history of the earth.

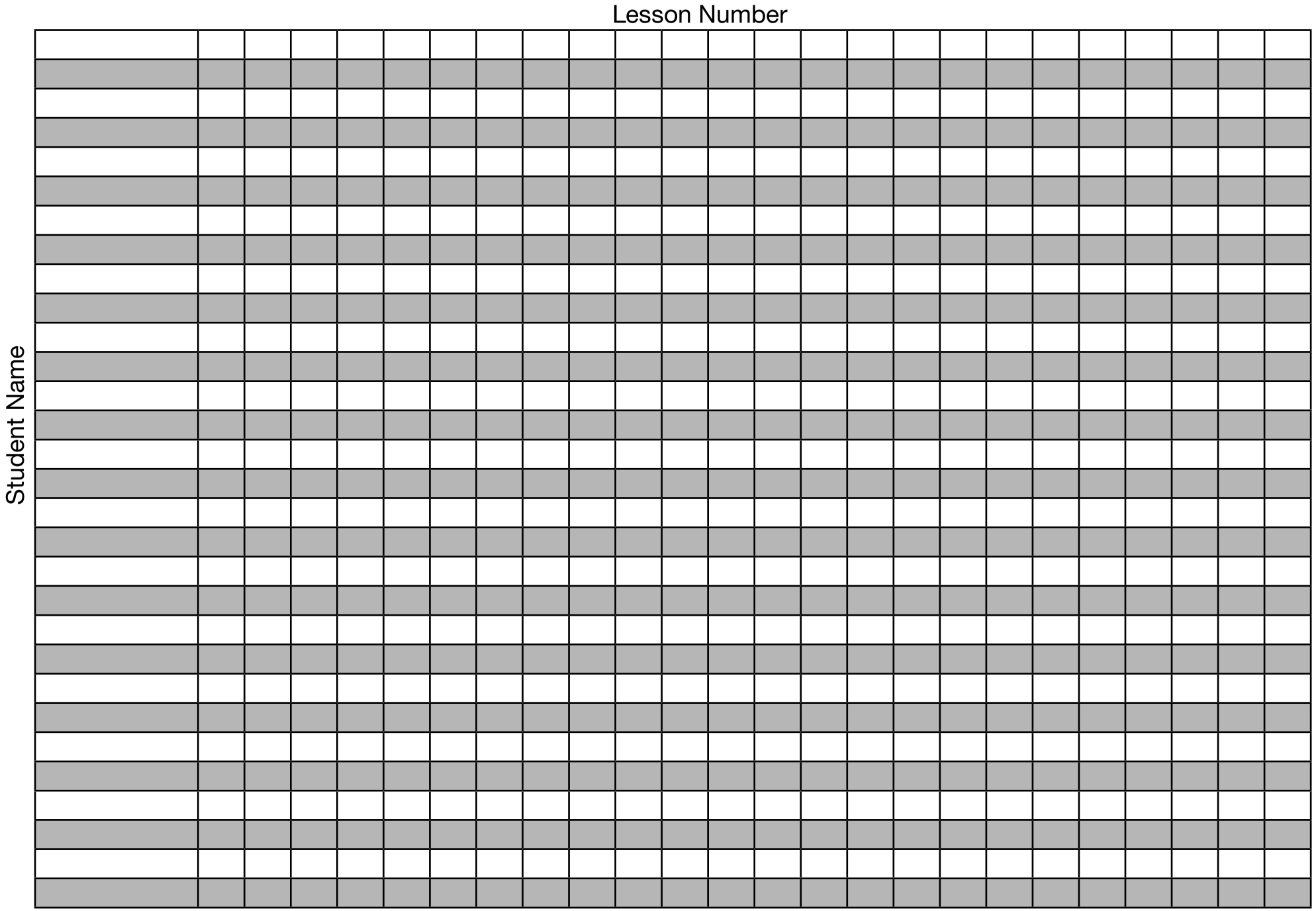
DA-3

Name **Answer Key**

Directions: Label the North Pole with 'N' and the South Pole with 'S.' Label the equator with 'E.' On the back of the paper, draw a picture of and write a sentence about the most interesting thing you learned about the history of the earth.

Tens Recording Chart

Use the following grid to record your Tens scores. Refer to page xi for the Tens Conversion Chart.



Lesson Number

Student Name

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