

**Earth Science Unit**  
**Material List**  
**Units A, B, & C**

**Unit A Earth Surface**

- Lesson 1 - one bucket per group  
One cup per group  
Disposable paint roller pan  
Soil & sand
- Lesson 2 - coffee filters  
Hand lens  
12 paper cups  
24 paper plates  
Paper towel  
Sandstone  
Soil  
Garbage bags
- Lesson 3 - Rocks  
Rulers  
Safety glasses  
Sand  
Scissors  
Shoebboxes  
Straws
- Lesson 4 - Topsoil  
Pebbles  
Sand  
Clay  
Hand lens  
Newspaper  
Paper cups  
Plastic grocery bags  
Soil/gravel sample taken from a riverbed  
Soil samples taken from students' homes or schoolyard  
Toothpicks or coffee filters
- Lesson 5 - Pumice  
Photos
- Lesson 6 - No materials needed

Lesson 7 - Elevation map of Michigan  
Elevation map of US  
Ice cubes  
Heater  
Sand  
Painting pans

## **Unit B Natural Resources**

### **Supply List**

*(for the lesson link 'People Using Natural Resources')*

Paper Plates  
String or yarn  
Index Cards  
Scissors  
Crayons  
Hole punch  
tape  
magazines

## **Unit C Reduce, Reuse, Recycle**

Lesson 1- Gloves

Garbage bags  
Chart paper

Lesson 2- Soil

Large containers w/lids  
Materials -thick wood, foil, newspapers, plastic, apples, worms

Lesson 3- Gloves

Plastic table cloths or table coverings

Lesson 4- No materials needed

Lesson 5- Cloth/recyclable grocery bag

Lesson 6- Paint

Markers

Glue

Tape

Recyclable materials

- Lesson 7- Corn starch  
Electric blender  
Glue sticks  
Large pan  
Magazine (one per child)  
Measuring cups (1/4 cup and 1/8 cup)  
Old newspapers (2 days)  
Recycled toilet paper (one package)  
Recycled cards (several)  
Recycled paper (varies types)  
Rolling pin  
Stirrer  
Wax paper  
Wire screening to fit over the pan
- Lesson 8- Chart paper  
Crayons  
Markers  
Pencils
- Lesson 9- T-Shirts  
Fabric markers  
Magazines (one per shirt)  
T-shirt iron on computer paper

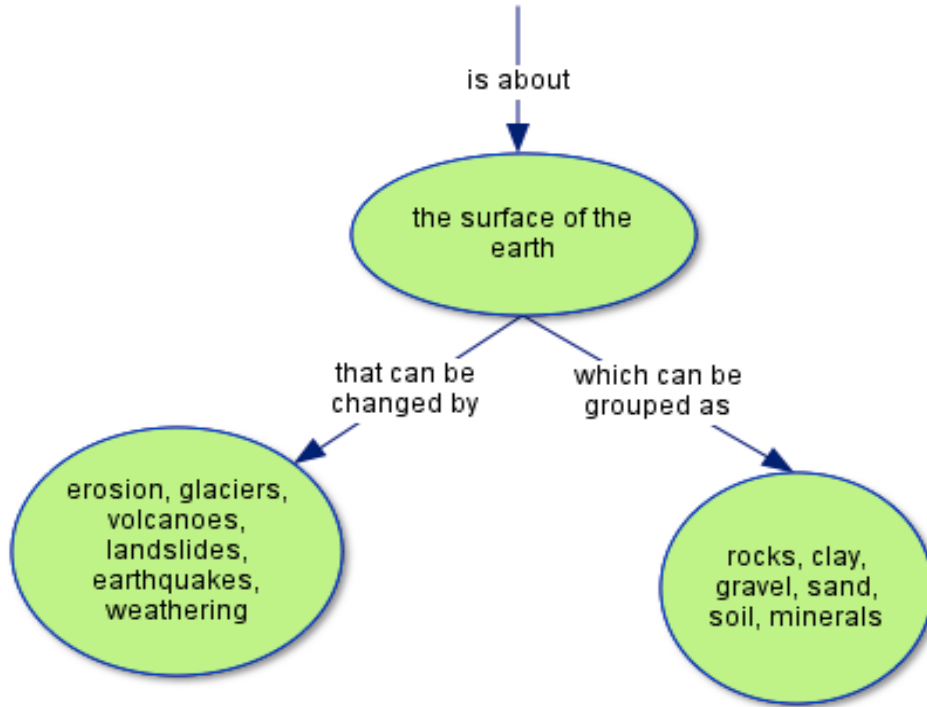
Oakland Schools Curriculum Unit Plan  
Third Grade: Structure and Function

**Unit A: Earth's Surface**

**Big Picture Graphic**

Overarching Question:

**What processes cause changes in the earth's surface?**



Questions to Focus Assessment and Instruction:

1. What are earth materials?
2. What evidence shows us that the earth's surface has changed over time?

Intellectual Processes:

Classifying  
Describing  
Identifying  
Researching

## **Unit Abstract**

This earth science unit introduces students to the characteristics and uses of earth materials (mineral, rock, clay, boulder, gravel, sand, soil) and the processes that cause changes in our earth's surface. They explore various earth materials to understand their origin and their useful qualities. Students recognize that rocks are made up of minerals and they learn what processes have changed the earth.

## **Grade Level Content Expectations**

Students will:

- recognize and describe different types of earth materials (mineral, rock, clay, boulder, gravel, sand, soil, water, and air) (E.SE.03.13).
- identify and describe natural causes of change in the earth's surface (e.g., erosion, glaciers, volcanoes, landslides, and earthquakes) (E.SE.03.22).
- recognize that rocks are made up of minerals (E.SE.03.14).
- develop research strategies and skills for gathering information about earth materials and for problem solving the various natural causes of change in the earth's surface (S.IA.03.14).

## **Key Concepts**

earth material

mineral

natural change

rock

**Duration:** 6 – 8 weeks

## **Supplemental Materials**

SCoPE Lesson 1 – Stream Flow

SCoPE Lesson 2 – Which Erodes Faster?

SCoPE Lesson 3 – Thar She Blows

SCoPE Lesson 4 – Let's Get Dirty

SCoPE Lesson 5 – Earth Power

SCoPE Lesson 6 – A Whole Lot of Shakin'

SCoPE Lesson 7 – Glaciers on the Move

## **Recommended (not required) Instructional Resources**

### Student Resource

Cole, Joanna. *The Magic School Bus: Inside the Earth*. New York: Scholastic, 1996.

Kalman, Bobbie. *Volcanoes on Earth*. New York: Crabtree Publishing, 2008.

---. *What Shapes the Land?* New York: Crabtree Publishing, 2009.

Malin, Stuart. *Story of the Earth*. Mahwah, NJ: Troll Associates, 1991.

Morganelli, Adrianna. *Minerals*. New York: Crabtree Publishing, 2004.

Morris, Neil. *Rocks and Minerals*. New York: Crabtree Publishing, 1998.

Parker, Steve. *Rocks and Minerals*. New York: Dorling Kindersley Publishing, 1997.

### Teacher Resource

Atwater, Mary, et al. *Changing Earth*. New York: Macmillan/McGraw-Hill, 1993.

---. *Earth Beneath Your Feet*. New York: Macmillan/McGraw-Hill, 1993.

Bishop, Gerry, ed. *NatureScope: Geology*. New York: Macmillan/McGraw Hill, 1989.

BSCS. *Investigating the Changing Earth*. Dubuque, IA: Kendall Hunt, 1999.

*A Closer Look at Space: Earth*. 100% Educational Videos. 2004. Discovery Education. 17 July 2009 <<http://streaming.discoveryeducation.com/>>.

Crossley, Helen. *Hardhatting in a GeoWorld*. Fresno, CA: AIMS Education Foundation, 1986.

Cuff, Kevin. *Stories in Stone (GEMS)*. Berkeley, CA: Lawrence Hall of Science, 1995.

Delta Science Modules. *Rocks and Minerals*. Hudson, NH: Delta Education, 1994.

---. *Earth Movements*. Hudson, NH: Delta Education, 1994.

FOSS. *Earth Materials*. Hudson, NH: Delta Education, 1993.

Hoover, Evalyn. *Primarily Earth*. Fresno, CA: AIMS Education Foundation, 1996.

*Rocks: The Solid Earth Materials: Part 02*. 100% Educational Videos. 2000. Discovery Education. 17 July 2009 <<http://streaming.discoveryeducation.com/>>.

### **Sample Performance Assessments**

1. Write a news report describing a real or fictional natural disaster. Include the damage, the relief efforts, and the impact on the area (E.SE.03.22, S.IA.03.14).
2. Research and analyze given samples of earth materials, select one earth material in which to describe in detail (E.SE.03.13, S.IA.03.14).

3. Given a small selection of rocks, classify each based upon their mineral make up and describe in writing the process used for classification (E.SE.03.14).

### **Connections**

#### English Language Arts

When studying natural changes of the earth, students can discuss how different forms of writing are used for various purposes.

#### Social Studies

As students analyze the devastation of natural disasters, they gain understanding of their social and economic costs.

## Unit 4: Earth's Surface Teacher Background

The central theme of this unit is that the Earth's surface is constantly changing. Teachers should note that this exercise introduces the processes of erosion, weathering, earth movements, volcanoes and glaciers as mechanisms that change the surface of the Earth. It does not provide details or include content about the mechanisms of this process. It is important to keep in mind that these processes illustrate that the surface of the Earth "wasn't always this way" – it moves, shifts, erodes, and builds – without getting into great detail in any single process.

This unit introduces the movement of Earth's surface materials on a "micro" scale—erosion and weathering, focusing on the playground. Students model erosion and compare several types of erosion. They proceed to look at examples of the process they have modeled in the world around them.

The unit progresses to illustrate other methods through which the Earth's surface changes:

- Deposition (covering fossils in a sequential matter that reveals secrets about geologic time)
- Earth movements such as earthquakes
- Volcanoes
- Movement of ice and glaciers.

In each case the emphasis is not on the details of the mechanism but on the constant way in which Earth's surface changes over time. Since students will have to go to photographic collections or the Internet to see volcanoes and earthquakes, this unit provides a nice link to social studies lessons about United States geography.

Geologic time is the most difficult concept in this unit, and will not be clearly understood by students in grade 3. However, by modeling the processes that they observe on a small scale they can construct the basic concepts which can be used to develop greater understandings in the middle school years.

### Concept Mapping

A concept map is a way of representing knowledge that is similar to a flow chart or organizational chart in a system. However, where organizational charts usually have one-way arrows (to show the flow of authority) a concept map may have two-way lines or links, showing relationships between ideas. The ideas themselves can be placed in circles or boxes. There is no one, universally accepted system. What is important for students is that you are consistent with this valuable graphical organizing system. "Concept maps are two-dimensional representations of cognitive structures showing the hierarchies and the interconnections of concepts involved in a discipline or a subdiscipline" ([Martin, 1994, p.11](#)).

Concept maps are closely related to the educational philosophy known as constructivism: "Children must build their own knowledge from experience. How they think influences how they learn, and only by analyzing their own thinking and understandings can they construct permanent understandings." They were first developed by Dr. Joseph D. Novak at Cornell University. By allowing students to communicate ideas, and then helping them express the relationships among their ideas in a concept map, teachers help children find the discrepancies between their ideas and what they observe in the real world.



Concept maps are especially important for children of diverse (non-verbal) learning styles. They help visual learners communicate ideas more effectively. They will take a little extra time, but used consistently they will pay off in more lasting learning.

## Photo Gallery (transparency masters)

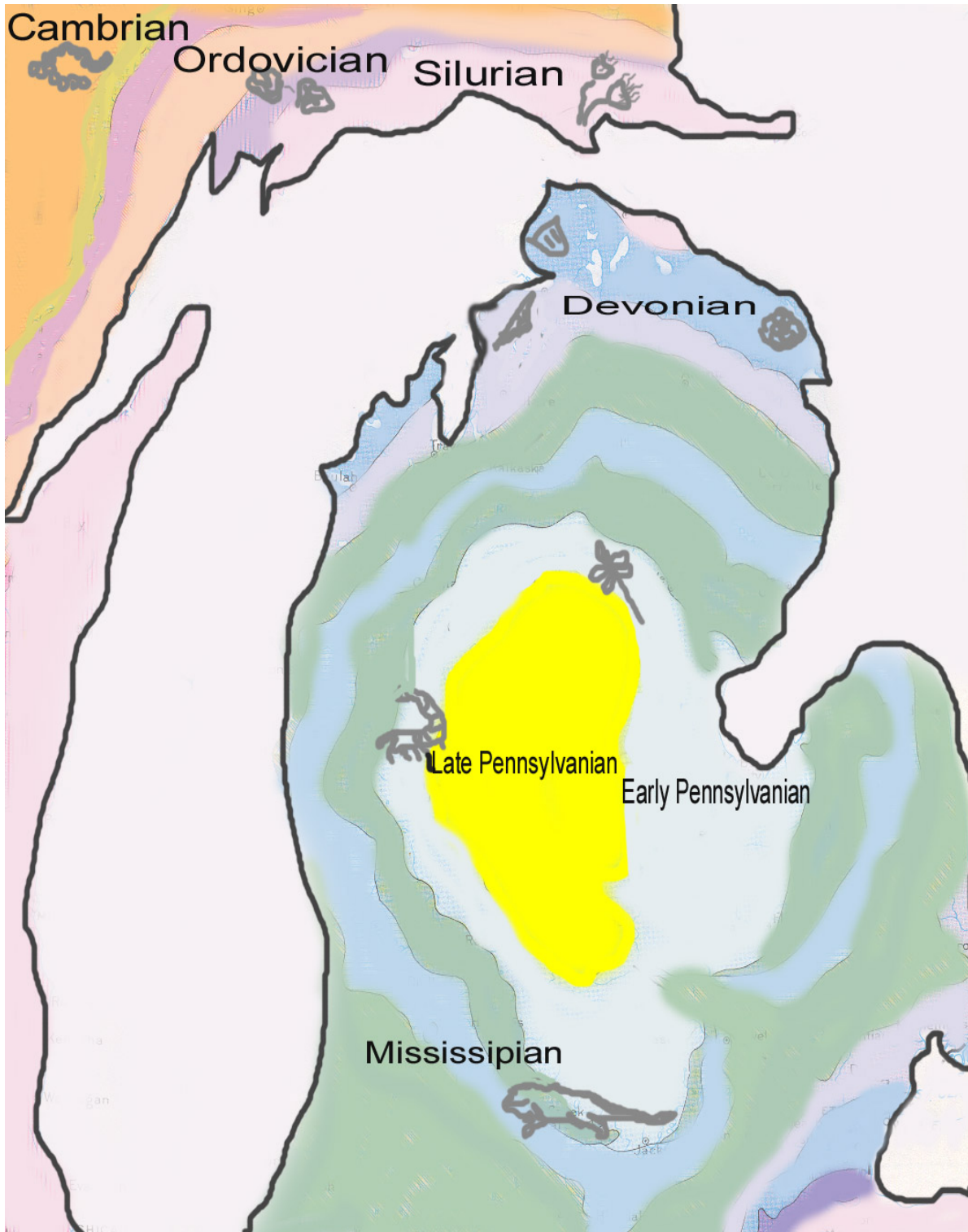
Paleozoic strata along I-75 in northern Kentucky



Water erosion on a Lake Huron beach

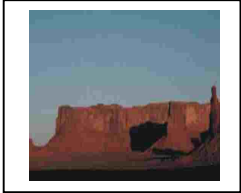




A Geologic Map of Michigan showing some fossils commonly found here.





## Word Cards for Unit 4

<p style="text-align: center;"><b>1</b> <b>canyon</b></p> <p>A deep valley with steep sides.</p>  <p><b>Example:</b> The river flows at the bottom of the canyon.</p>	<p style="text-align: center;"><b>2</b> <b>plateau</b></p> <p>A flat area high above a surrounding plain.</p>  <p><b>Example:</b> The plateau is high above the plain.</p>
<p style="text-align: center;"><b>3</b> <b>weathering</b></p> <p>The breaking apart or wearing down of soil or rock by wind or water.</p>  <p><b>Example:</b> Weathering wore down the surface of the mountain.</p>	<p style="text-align: center;"><b>4</b> <b>natural forces</b></p> <p>Forces created by nature.</p> <p><b>Example:</b> Wind and rain are natural forces that change the surface of the earth.</p>
<p style="text-align: center;"><b>5</b> <b>model</b></p> <p>A small copy of something.</p>  <p><b>Example:</b> A globe is a model of the earth.</p>	<p style="text-align: center;"><b>6</b> <b>stream flow</b></p> <p>The direction water flows in a stream.</p>  <p><b>Example:</b> The stream flow carried the sand downhill.</p>

**7  
erosion**

The wearing away of the earth's surface by wind or water.

**Example:** The erosion of the rock made it very smooth.

**8  
valley**

A long area of low land between mountains or hills.



**Example:** The valley is covered with rocks and trees.

**9  
dike**

A barrier of sand or soil.



**Example:** The dike was created from sand deposits along the river.

**10  
delta**

An area of sand and soil deposited at the mouth of some large rivers.



**Example:** This delta is at the mouth of the Mississippi River.

**11  
humus**

Bits of decayed plants and animals.



**Example:** The minerals in humus help plants to grow.

**12  
sand**

Particles that we can clearly see.



**Example:** The sand on the beach was very hot.

**13  
silt**

Particles that we can barely see.



**Example:** The lake had a lot of silt on the bottom.

**14  
clay**

Particles that are impossible to see.



**Example:** It is easy to slide on the wet clay.

**15  
pebbles**

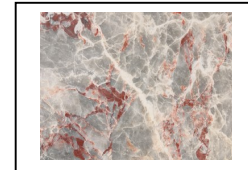
Small, smooth rocks.



**Example:** The action of the water made the pebbles smooth.

**16  
mineral**

A substance formed in the earth.



**Example:** The minerals give the marble its color.

**17  
quarry**

A large open hole used for mining.



**Example:** Stone is being mined from the quarry.

**18  
iron**

A heavy, gray metal.



**Example:** Nails are made of iron.



**19**  
**copper**

A reddish-brown metal.



**Example:** Pennies are made of copper.

**20**  
**gravel**

A mixture of stones and pebbles.



**Example:** Gravel is used as the surface of some roads.

**21**  
**limestone**

A rock formed from shells and other animal remains.



**Example:** The wall is made of limestone.

**22**  
**gypsum**

A soft mineral used to make drywall and other materials



**Example:** The drywall is made out of gypsum.

**23**  
**geologist**

Someone who studies the physical earth and how it has changed over time.



**Example:** The geologist found clues about the earth by studying the rocks

**24**  
**sediment**

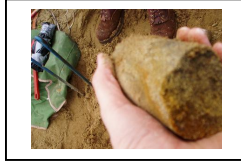
Solid material that settles to the bottom of a liquid.



**Example:** The sediment was left behind when the lake dried up.

**25**  
**core sample**

A tube-shaped piece of something taken as a sample.



**Example:** The core sample will help us to learn more about the soil.

**26**  
**strata**

Layers of rock.



**Example:** The strata could be seen in the Pictured Rocks over Lake Superior.

**27**  
**archaeologist**

Someone who studies past human life.



**Example:** The archaeologist found pottery, tools, and other things.

**28**  
**paleontologist**

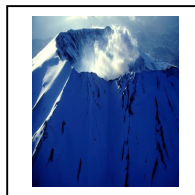
Someone who studies clues about the earth.



**Example:** The paleontologist found the remains of a dinosaur.

**29**  
**volcano**

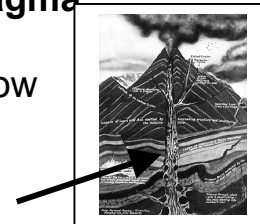
An opening in the earth's surface through which melted rock, ash, and gases are forced out.



**Example:** The volcano is ready to erupt.

**30**  
**magma**

Molten rock below the ground.



**Example:** We cannot see magma because it is below the earth.

**31  
lava**

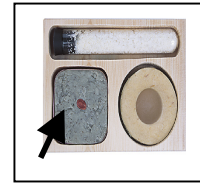
Hot, melted rock that erupts from a volcano.



**Example:** The hot lava poured out of the volcano.

**32  
pumice**

A spongy form of volcanic rock.



**Example:** Pumice stones are used to smooth rough feet.

**33  
earthquake**

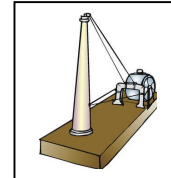
Shaking of part of the earth's surface caused by movement deep within the earth.



**Example:** The earthquake caused a lot of damage.

**34  
seismograph**

An instrument used to measure the strength of earthquakes.



**Example:** The seismograph showed the strength of the earthquake.

**35  
geyser**

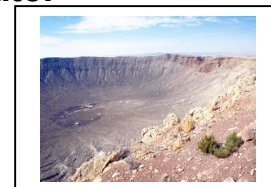
A spring that shoots hot water or steam into the air.



**Example:** The geyser shot high into the air.

**36  
crater**

A hollow area shaped like the inside of a bowl.



**Example:** This crater was made by a meteor.

**37**  
**glacier**

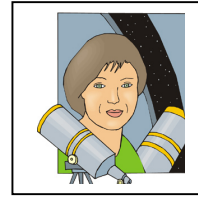
A large mass of ice made from compacted snow.



**Example:** More and more glaciers are melting into the ocean.

**38**  
**planetologist**

Someone who studies the physical features of the planets.



**Example:** The planetologist learned that there was once water on Mars.

**39**  
**Ice Age**

A long period of time when glaciers covered large parts of the earth.



**Example:** Michigan was covered with ice and snow during the Ice

**40**

## Questions Chart for Unit 4

<b>Question</b>	<b>Answer</b>
<b>What is weathering?</b>	Weathering is the breaking apart or wearing down of soil or rock by wind or water.
<b>What is water erosion?</b>	Water erosion is the movement of particles from one place to another caused by water.
<b>What is wind erosion?</b>	Wind erosion is the movement of particles from one place to another caused by wind.
<b>What is humus?</b>	Humus is bits of decayed plants and animals.
<b>What are some earth materials that are found in Michigan?</b>	Iron, copper, gravel, limestone, and gypsum are earth materials that are found in Michigan.
<b>Are the oldest layers of rock found at the top or the bottom of the strata?</b>	The oldest layers of rock are at the bottom of the strata.
<b>What is a volcano?</b>	A volcano is an opening in the earth's surface through which melted rock, ash, and gases are forced out.
<b>What is an earthquake?</b>	An earthquake is the shaking of part of the earth's surface caused by movement deep within the earth.
<b>What is a glacier?</b>	A glacier is a large mass of ice made from compacted snow.

Graphic Organizer for Unit 4

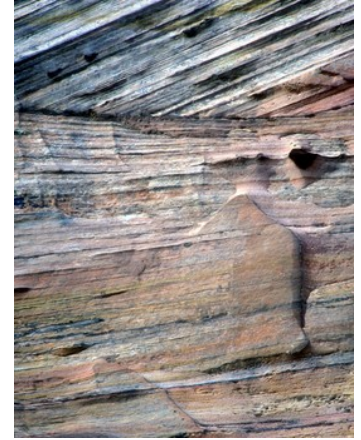
Erosion



Weathering



Strata



The Earth and Its Changes

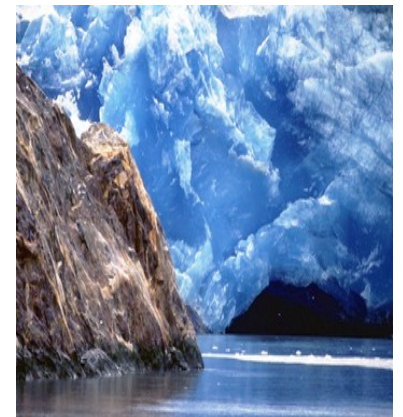
Volcanoes



Earthquakes



Glaciers



# How did the Grand Canyon form?



Seven million years ago, a stream flowed across the Colorado Plateau.

The Earth pushed the land up and made the plateau become sloped. Wind, water, and ice weathered the rock.

The river flowed faster causing more wearing away of the rock.

# Two Types of Weathering

## Chemical Weathering

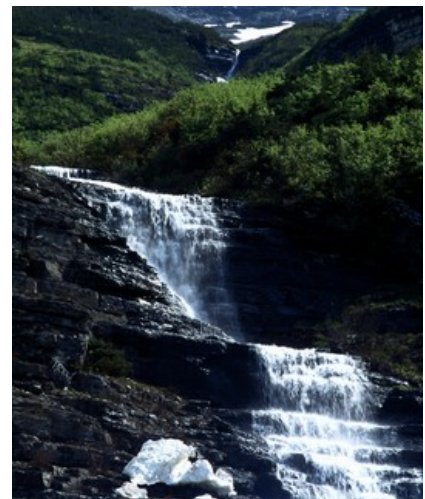


## Physical Weathering

### Wind



### Water





Soil on hilly land erodes faster than soil on flat land.

Hilly land




Flat land




# Two Types of Erosion

**Water  
Erosion**

A photograph showing a steep, layered rock cliff face with a rocky beach in the foreground, illustrating water erosion.

**Wind  
Erosion**

A photograph showing a desert landscape with a prominent, eroded sandstone cliff face and a valley floor, illustrating wind erosion.

Graphic Organizer for Lesson 4

**Sand**



**Silt**



**Clay**



**What Makes Up Soil?**

**Humus**



**Pebbles**



Graphics for Lesson 4

# Bricks



# Concrete



# Soil



# Marble



## Graphic Organizer for Lesson 5

Lava hardens  
into rock.



Ash covers the  
ground.



Volcanoes Change the  
Surface of the Land

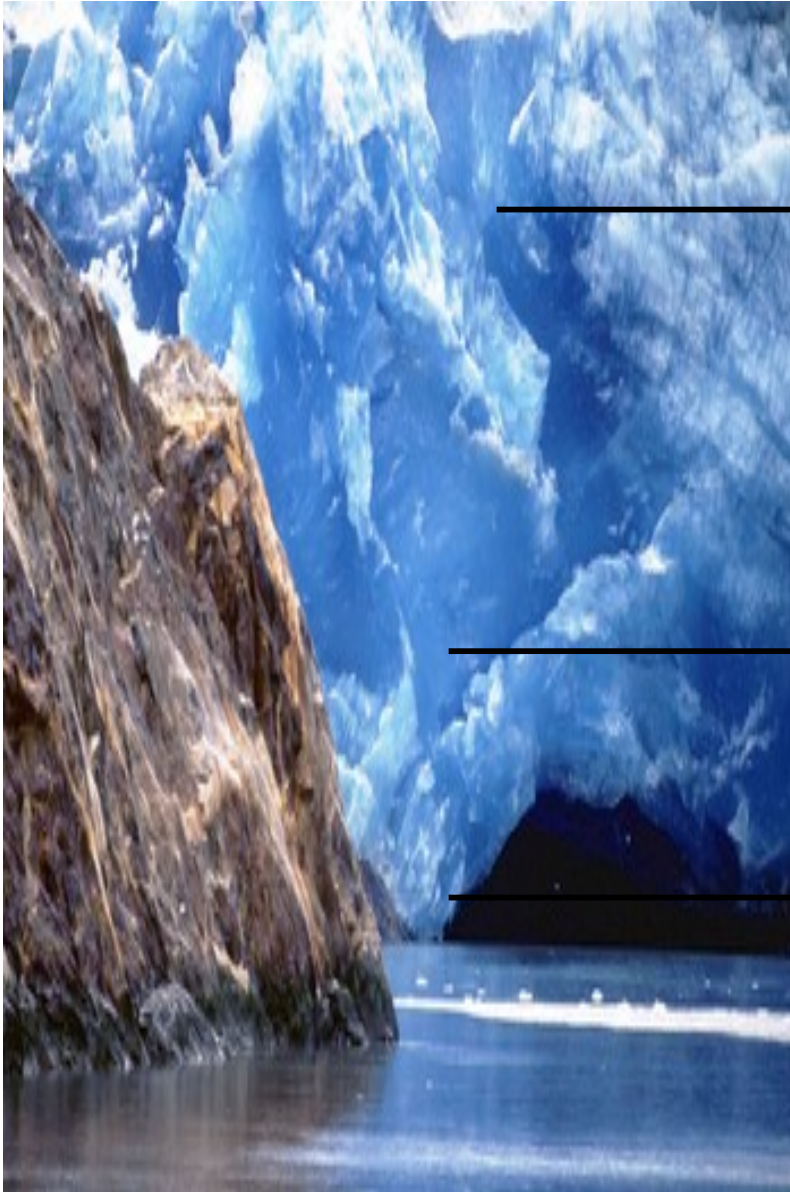
Lava and ash  
fill in lakes.



Eruptions cause  
mountainsides  
to collapse.



# How does a glacier form?



Snow comes down. It gets deeper and deeper. If the snow does not melt before the next cold season, it becomes a glacier.

The bottom layers get packed down. They turn into ice.

A thin layer melts underneath the ice. The glacier begins to move across the land.

## Big Ideas of the Lesson

- A canyon is a deep valley with steep sides.
- A plateau is a flat area high above a surrounding plain.
- Canyons are formed by natural forces such as weathering and erosion.
- Weathering is the breaking apart or wearing down of soil or rock by wind or water.
- There are two types of weathering – chemical weathering and physical weathering.
- Erosion is the wearing away of the earth's surface by wind or water.

## Abstract

In this lesson students examine photos of the Grand Canyon and other national parks to discover the effects of natural forces on the land. They make a stream table to model the effects that they see.

## Grade Level Context Expectation(s)

Students will:

- identify and describe natural causes of changes in the earth's surface (e.g., erosion, glaciers, volcanoes, landslides, and earthquakes) (E.SE.03.22).

## Key Concept(s)

earth material

natural change

## Instructional Resources

### Equipment/Manipulative

Bucket (1 per group to catch water)

Cups (8 ounce paper or plastic, 1 per group)

Disposable paint roller pan

Garbage bag (1 per group)

Loamy soil (2 cups mixed with sand in 1:4 ratio)

Paper towels

Poster or picture of the Grand Canyon (or computer access)

Water (2 cups per group)

### Student Resource

Promethean Flip Chart : Weathering and Erosion

<http://www.prometheanplanet.com/en/Resources/Item/42634/weathering-and-erosion#.U8M+VvldUik>

*Grand Canyon Explorer.* Ed. Bob Ribokas. 1994-2009. 17 July 2009  
<<http://www.kaibab.org/>>.

Kalman, Bobbie. *What Shapes the Land?* New York: Crabtree Publishing, 2009.

Henderson, Janice, and Juliana Texley. *Supplemental Materials (SC03040101.doc)*. Teacher-made material. Waterford, MI: Oakland Schools, 2009.

*National Park Service*. U.S. Department of the Interior. 17 July 2009 <<http://www.nps.gov/>>.

#### Teacher Resource

Henderson, Janice, and Juliana Texley. *Grade 3 Unit 4 Teacher Background (SC030400TB.doc)*. Teacher-made material. Waterford, MI: Oakland Schools, 2009.

National Science Teachers Association. *Dig In: Hands On Soil Investigations*. Arlington, VA: National Science Teachers Association, 2001.

#### **Sequence of Activities**

Advance Preparation: Log into one of the websites to find a picture of the Grand Canyon and post it in the room where students can observe it.

Punch a 2" hole or notch cut the center of the short end of the paint pan where the bottom meets the side edge. Punch four holes in each of the cups. Try the experiment first because different soils will require different amounts of water. If the soil is very sandy, you may want to add a third cup of water. Sandier soil has heavier, less permeable particles and more time will elapse before erosion starts to occur.

**Note:** Under Teacher Resource is a materials sheet listing all of the equipment and manipulatives needed throughout this unit. It includes estimated costs, sources, and other helpful information.

1. Begin with a walking tour of the school playground. Find evidence of erosion. (Look under swings and the slide to start.) Ask students: "What caused the hole/ditch?" [Water, moving feet.]
2. Ask students to look at the picture of the Grand Canyon. Ask them what they notice. They should see that the river is at the bottom of the canyon. They should see that the rock has been cut or worn away. They may say that there are layers in the rock of the Grand Canyon. Ask students what role they think the river played in the canyon. (If they do not make the connection of water changing the land, refer them to their observation of moving water near their school.) Explain: Seven million years ago, a stream flowed across the Colorado Plateau. As Earth forces uplifted the land, it caused the plateau to become more sloped. Wind, water, and ice weathered the rock of the plateau. Chemical weathering by the roots of plants continued the process. As the plateau was uplifted, the river flowed faster increasing the weathering and erosion of the Grand Canyon rock.

This activity introduces students to the general question, "How do natural forces cause changes in the earth's surface?" The first natural force that students investigate is erosion by water. However, the effects of erosion are intermingled with physical weathering in the Grand Canyon's formation and in this introductory activity.

3. Tell students that today they will make a model to show how a river or moving water forms a ditch or canyon. Tell them that sometimes scientists need to make models to study things that happen around them. Ask them why scientists would make a model. [They need to make a model



because the Grand Canyon is too far away to study and too large to see the effects of moving water. Another reason is that it takes too long in time to notice the effects of moving water carving the canyon.]

**Note:** The extent of geologic time is very difficult for students of this age to conceptualize. Students will have difficulty imagining the effects of such small processes over such vast periods. You may wish to discuss what North America was like at that time, including some mammals (like saber-toothed tiger and horse ancestors) that may be familiar to students.

4. Divide the students into groups. Select one person in each group to collect all the necessary supplies. Lay the garbage bags on the desks or table area. This will help minimize water spills. Follow the directions on the Student Page to make the stream table. Make sure students have their buckets directly under the hole in the paint pan and pour the water slowly and hold the water container steady, so that the water drips into one constant area.
5. Ask students to notice where the water goes just after they begin letting the water drip. [The water soaks into the soil/sand mixture.] Have them continue to let the water drip slowly. Ask them to observe what happens to the land and water. [The water begins to cut into the land and carries small particles of soil away with it.] Introduce the term *erosion*.
6. Have students discuss what they observe as they continue to let the water drip. Discussion questions about the path that the water took include:
  - Did the water go straight to the other end or did it take more of a curved path?
  - Did the water take one path or branch out?
  - What happened to the land as the water made a path?
  - Did it carry the sand and/or dirt with it? Was the water that ran into the bucket or the other end of the painting tray clean or dirty? [Answers will vary.]
7. Have students begin to clean up. Remember not to pour the dirty water down the drain as the drain might clog up. Instead, pour the excess dirty water into one bucket. Throw that water out the window or door to the outside. Spread the soil mixture across the pan or on the plastic garbage bag to dry. It will be used in the next lesson.
8. Ask students to compare and contrast their models to the evidences of erosion they saw in the playground or in pictures of the Grand Canyon.
9. Photograph a student experiment to retain for the end-of-unit activity.

### **Assessment**

Ask students to interpret the photo of an eroded beach or the erosion fence in a short paragraph. The rubric should be related to understanding of the benchmarks.

### **Application Beyond School**

Students can log into the national parks website and look for landforms that are created because of moving water at the base of the canyons. The number one cause of river pollution in the Mississippi is erosion from farm tilling. Students may wish to research new methods of “no-till” farming to reduce erosion.

### **Connections**

## English Language Arts

Students can log into the national park website and can orally describe the effects of moving water on the land and give a short written summary of the changes made by water and wind.

### **Lesson 1: Stream Flow**

Today you will make a model to show the effects of water on the land. You will pour water on soil mixed with sand and watch or observe what happens.

**Problem:** What happens to the land when water falls on it?

**My Hypothesis:** \_\_\_\_\_

**Procedure:**

1. Cover your table with a large plastic bag. You will be working with water and the bag will help keep the area dry.

2. Your teacher will give you a paint roller pan. This will be a model for a gently sloping hill. Take two cups of soil mixture and gently cover the bottom of the pan. Observe the kind of soil you are using. Pat the soil gently in the pan and then wipe your hands. Put the edge of the pan just over the edge of the table. Fix the bucket on the floor so that it will be under the hole to catch the water.
3. Take the cup with the holes in the bottom and hold it over the soil near the highest edge of the pan. *Carefully and slowly* pour the water into the cup and let the water drain out of the cup. This is similar to rain on the soil. Keep the cup in the same place and try not to move it. Continue to pour the water and let it drip until all of the water is gone. Look very carefully and observe what the water does to the soil.
4. Draw what you observe in sequence. Make *Before*, *When One Cup of Water Is Poured*, and *After* drawings. Label the water, land, and path(s) the water takes.

## My Observations

<b>Before</b>	<b>When One Cup of Water Is Poured</b>	<b>After</b>

## My Conclusions:

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## Picture Puzzlers

When builders clear the land for new construction, they must put up a little fence like this around their site. Use your knowledge of soils to explain what this fence is for and how it helps.



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This is the way a beach along Lake Huron looked after a rain. Can you explain it?



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## Lesson 2: Which Erodes Faster?

### Big Ideas of the Lesson

- Moving water erodes land.
- Hills erode faster than flat land.

### Abstract

In this lesson students build upon the understanding of erosion developed in Lesson 1 by investigating which erodes faster, flat land or hills. They expand their understanding of changes to include physical weathering.

### Grade Level Context Expectation(s)

Students will:

- identify and describe natural causes of change in the earth's surface (e.g., erosion, glaciers, volcanoes, landslides, and earthquakes) (E.SE.03.22).
- develop research strategies and skills for gathering information about earth materials and for problem solving the various natural causes of change in the earth's surface (S.IA.03.14).

### Key Concept(s)

earth material

natural change

### Instructional Resources

#### Equipment/Manipulative

Bucket (to catch water, 1 per group)

Coffee Filters (4 per group)

Garbage bags (per group)

Hand lens (1 per group)

Paper cups (2-8 ounce per group)

Paper plates (4 per group)

Paper towels

Sandstone (samples)

Soil (4 cups, loamy)

Water (4 cups per group)

#### Student Resource

Promethean Flipchart: Weathering and Erosion

<http://www.prometheanplanet.com/en/Resources/Item/42634/weathering-and-erosion#.U8MtVvldUik>

Turnip Rock Michigan erosion examples: <http://impressivemagazine.com/2011/12/13/turnip-rock-lake-huron-michigan/>

Henderson, Janice, and Juliana Texley. *Supplemental Materials (SC03040201.doc)*. Teacher-made material. Waterford, MI: Oakland Schools, 2009.

Kalman, Bobbie. *What Shapes the Land?* New York: Crabtree Publishing, 2009.

### Teacher Resource

Henderson, Janice, and Juliana Texley. *Grade 3 Unit 4 Teacher Background (SC030400TB.doc)*. Teacher-made material. Waterford, MI: Oakland Schools, 2009.

### **Sequence of Activities**

1. Review Lesson 1 with the students. Ask them what happened when they poured the water on the soil. "What path did the water take?" [In the beginning the water soaked into the soil. Then the water traveled downhill. It carved a curved path into the soil that might have split into different smaller streams. Those streams ended up at the opposite end of the pan.] "What did the water do to the soil?" [The water soaked into the land at first. Then it carved a curved path. It eroded the land.] Ask whether the water was clean or dirty at the other end of the pan. [It was dirty.] "Why was the water dirty?" [It had particles of the soil in it.] Tell students that the movement of soil particles is called "erosion." [Your discussion may touch on where the particles come from. Weathering is the breaking apart or wearing down of soil or rocks. Wind, ice, and rain can break large rocks into smaller pieces. The movement of those soil or rock particles is erosion.]
2. Tell students that today they will investigate whether flat land or hilly land erodes faster. They will make models to compare landforms. Ask them where have they seen flat land. (It might be around their school, in central Michigan, or in the Great Plains if they are studying the United States.) Ask them where the land is hilly. (They might refer to the Brockway Mountains and Porcupine Mountain, both in the Upper Peninsula, to hills in Lower Michigan, or to hills they have seen on vacations. Perhaps the land around their school is hilly.)
3. Divide the students into large groups. Within each group there will be two stream tables set up. One person in each group should collect all the necessary supplies. Lay the garbage bags on the desks or table area. This will help minimize water spills. Follow the directions on the Student Page to make the stream table. One stream table setup in each group should have the soil applied flat as in Lesson 1. The second table should have the soil in hills and valleys. Make sure students pour the water slowly and hold the water container steady, so that the water drips into one constant area. In order to make sure the experiment is a "fair test" students may want to practice pouring the water slowly, or they may elect the same student to pour the water on both setups.
4. Ask students to notice where the water goes just after they begin letting it drip. (The water soaks into the soil/sand mixture.) Continue to let the water drip. Ask them to observe what happens to the land and water. (The water begins to cut into the land and carries small particles of soil away with it. They notice that the water on the hilly land erodes the land more deeply than the flat land. Hilly land erodes faster.)
5. Have students discuss what they observe as they continue to let the water drip. If the soil is very sandy, you may want to add a third cup of water. The sandier soil soaks up more water before erosion starts to occur, as does the flat land. Discussion questions about the path that the water took include:
  - Did the water go straight to the other end or did it take more of a curved path? [Curved.]
  - Did the water take one path or branch out? [Branch.]
  - What happened to the land as the water made a path? [Some was carried away.]



- Did the flat land or hilly land erode faster? [Hilly.]
  - Would the land in central Michigan (flat) erode faster or slower or the same as the land in the Brockway Mountains (hilly)? [Hilly.]
  - Did it carry the sand and/or dirt with it? [Yes.] Was the water that ran into the bucket or the other end of the painting tray clean or dirty? [Dirty.]
6. Have students begin to clean up. This time leave the soil to dry. Take the dirty water in the bucket and slowly pour it through a coffee filter into another bucket. Let the coffee filter and any soil in the bucket dry on a paper plate. Both the eroded soil at the bottom of the pan and in the coffee filter will be used in Lesson 4.
  7. Ask students to read the selection on the Grand Canyon. Show them a sample of sandstone and allow them to examine it with a hand lens to see the tiny grains of sand in its structure. Assign a written response to the reading passage.
  8. Take photos of the student experiment to use on your bulletin board.

### **Assessment**

Students should have the basic understanding that moving water erodes the land, the movement of the land particles is called “erosion,” and that sloped land erodes faster than flat land. The photo of an expressway hill can be used as a writing prompt.

### **Application Beyond School**

When expressways are built, the sides must quickly be sodded or hydroseeded and covered with straw. Laws protect beach grasses that have deep roots in the sand. Students should understand the purposes for these measures.

### **Connections**

#### Social Studies

Students may wish to role-play a debate about the laws that prohibit the operation of motorized vehicles on beaches. (They tear up the roots of plants that prevent erosion.)

## Lesson 2: Which Erodes Faster?

**Problem:** Does water erode flat or hilly land faster?

**My Hypothesis:** (*Be specific*) \_\_\_\_\_

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**Procedure:**

1. Cover your table with a large plastic bag. You will be working with water and the bag will help keep the area dry.
2. Your group will have two paint pans for this experiment. Put two cups of soil very flat in one of the pans. In the other pan, make hills and valleys in the soil. Do not leave any part of the pan bare (with no soil). Put the edge of the pan just over the edge of the table. Fix the bucket to catch the water.
3. Take the cup with the holes in the bottom and hold it over the land near the highest edge. *Carefully and slowly* let the water drain out of the cup. This is similar to rain on the soil. Try not to move the cup. Continue to pour the water and let it drip until it is gone. Make sure you pour the water at the same speed as the other groups. Look very carefully and observe what the water does to the soil. Put water on the second pan *in exactly the same way* to have a fair test.
4. Draw what you observe.

**My Observations**

Erosion on Flat Land	Erosion on Hilly Land

**My Conclusion:**

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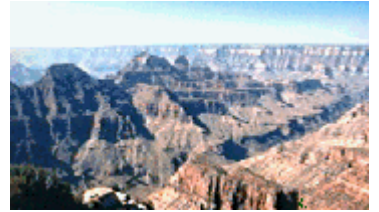
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## History of the Grand Canyon

The Grand Canyon did not always look the way it does today. It began over seven million years ago. Once that land was the bottom of a great inland sea. A sedimentary rock called sandstone formed there. After millions of years, heat and pressure within the earth forced the sandstone up. The Colorado Plateau formed there. (A plateau is a flat area high above a surrounding plain.)

Over many years, wind and rain wore the sandstone down. Water froze in tiny cracks and expanded. The cracks grew larger. Roots of plants pushed into the cracks making them even wider. When the cracks got very large, rocks broke and gravity pulled them downward. All these changes are called weathering. Soon dead parts of plants mixed with the sand and formed soil.

The Colorado River flowed across the plateau, westward to the Pacific Ocean. As the plain rose, the force of gravity made the river flow faster. The racing water cut a path through the soft sandstone. The path grew a little deeper each year. The river carried the soil across the plain, down to the sea. Soon the river's path became a valley. The sand and soil carried by the river ended up in the Imperial Valley in Southern California.



No living thing could see the changes that were made by weathering and erosion. Each year the river cut only a little deeper. But over seven million years, weathering and erosion created miles of canyon walls. If you look carefully, you can still see the layers of sandstone made under the sea millions of years ago.

The Colorado River still flows through the Grand Canyon. You can see it if you look down the canyon walls. It still carries small particles of sand and soil westward toward the sea. Sometimes the river flows quickly, but other times it drops so much sediment that it creates a muddy dike in Southern California. (A dike is a barrier of sand.) Then the river stops and the water evaporates before it ever reaches the Pacific. Nothing has ever been able to stop the Colorado River but itself!

Write a paragraph on weathering and erosion in the Grand Canyon. Include what you know about erosion of hills.

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This hill is on the side of an expressway. What helps keep the soil from eroding here?

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## Lesson 3: Thar She Blows!

### Big Ideas of the Lesson

- Wind can erode the land and move sediment to new places.
- Wind changes the size and shape of the land.
- Sand dunes occur where the wind is strong and steady.
- Rocks act as a shield when the wind blows.

### Abstract

In this lesson students expand their understanding of weathering and erosion to include the effects of wind. They examine the effects of wind at National Park sites. Then students investigate the effects of wind erosion through modeling.

### Grade Level Context Expectation(s)

Students will:

- identify and describe natural causes of change in the earth's surface (e.g., erosion, glaciers, volcanoes, landslides, and earthquakes) (E.SE.03.22).
- develop research strategies and skills for gathering information about earth materials and for problem solving the various natural causes of change in the earth's surface (S.IA.03.14).

### Key Concept(s)

earth material

natural change

### Instructional Resources

#### Equipment/Manipulative

Rocks (3 per group)

Rulers (1 per group)

Safety goggles (class set)

Sand (about 1 cup per group)

Scissors (1 per group)

Shoebox (1 per group)

Straws (1 per student)

#### Student Resource

United Streaming Video: *TLC Elementary School: Protecting Our Planet*

<http://app.discoveryeducation.com/player/?assetGuid=2360B80C-2B32-4310-989E-77A1AF2E8463&layout=standalone>

You Tube Video: *Wind Erosion* <http://www.youtube.com/watch?v=PQmon7Rj6ns>

Bill Nye: *Erosion* <http://www.youtube.com/watch?v=Xdg1lpQfLbo>

Henderson, Janice, and Juliana Texley. *Supplemental Materials (SC03040301.doc)*.  
Teacher-made material. Waterford, MI: Oakland Schools, 2009.

Kalman, Bobbie. *What Shapes the Land?* New York: Crabtree Publishing, 2009.

*Parknet: Sleeping Bear Dunes*. National Park Service. 17 July 2009  
<<http://www.nps.gov/slbe/index.htm>>.

#### Teacher Resource

Henderson, Janice, and Juliana Texley. *Grade 3 Unit 4 Teacher Background (SC030400TB.doc)*.  
Teacher-made material. Waterford, MI: Oakland Schools, 2009.

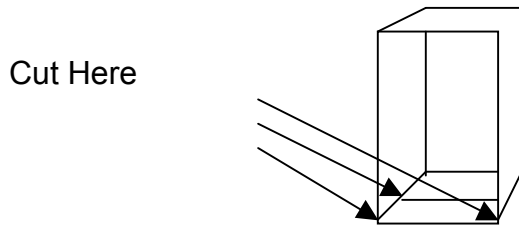
#### **Sequence of Activities**

Advance Preparation: Log into a website and collect some pictures of wind erosion. Sleeping Bear Sand Dunes in Michigan is one good example. Either print the pictures or bookmark the website for a virtual field trip.

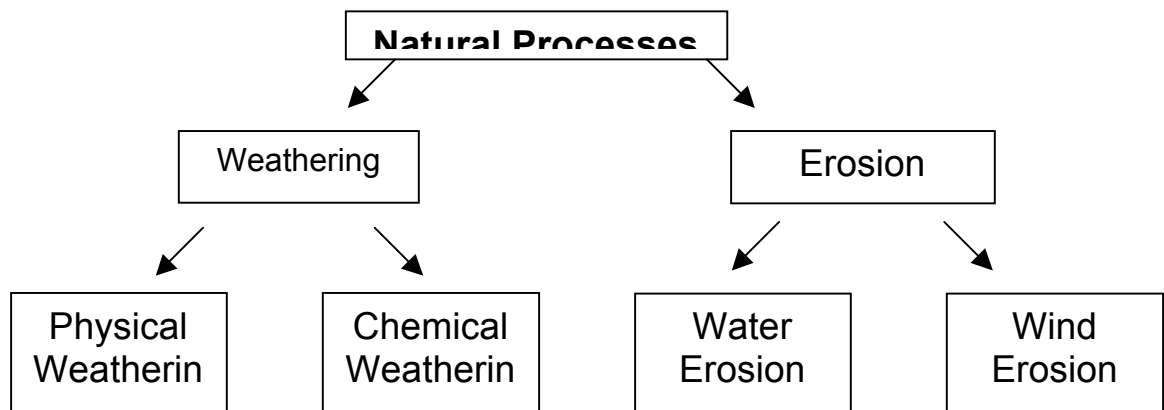
Safety Precautions: Eye protection should be worn throughout. Wash goggles after use.

1. Ask students to close their eyes and take an imaginary walk with you on a sandy desert: "It is hot and dry. A strong wind comes up. It begins to blow the sand. The wind becomes stronger..." Ask: "How would the sand feel against your skin?" [The sand stings as it hits their face or body.] "If the sand is on the ground, how come you can feel it on your face?" [Because the wind's energy picks up the sand on the ground and blows it.] "What might happen to the sand after it hits your face?" [It might blow somewhere else, but eventually will fall to the ground.] "If the wind picks up the sand will it drop the sand in the same place as it was lifted?" [Probably not.] Ask: "What other process do you know that can pick up bits of sand and carry them?" [Water erosion.] Tell students that wind can not only weather rocks but also can erode the land and move sediment to new places.
2. Ask students where they have seen a large pile of sand. [Their first answer might be a man-made pile, but encourage them to think farther.] Remind them of dunes and seashores. Introduce pictures of Sleeping Bear Dunes.
3. Tell students that today they will build a model the wind and study the effects of wind erosion. Ask again why scientists use models. [They can study processes that are very large, very small, or very fast or slow.] Student will be the wind and blow the grains of sand. They should develop a hypothesis about what will happen on their Student Pages.
4. Have students begin to make a wind box. Each group should get a shoebox and draw a horizontal line across the short end of the shoebox about 2 cm from the bottom. Cut along the line and up the two edges of the short side. One of the short sides should now be taller than the cut side. Place the box on a desk or table. (**Note:** You may want to do this activity outside if the class is active.) Put one cup of sand into the box. Spread it out evenly. Take a drinking straw. Place one

end on the cut edge of the shoebox. Have one student blow through the straw at the sand. (Caution the students to blow carefully and slowly. Goggles must be worn throughout the exercise.) Have the students take turns blowing the sand. The other members of the group should observe what changes they see and record those changes on the Student Page.



5. Have students smooth out the sand and place three rocks somewhere on the sand. Have students predict what will happen. Repeat the blowing process. Remind the students to try to blow with the same slow force. Observe changes in the sand. Discuss how these changes are similar/different from wind erosion without the rocks.
6. Relate the investigation to real-world phenomena. Refer students to the picture of the sand dune in the Student Pages. Ask them to write how they feel the wind changed the land. Take photos of student models for later use. Some questions for discussion: “What is the effect of wind on soil and sand?” [It picks up soil and sand, erosion.] “What does it do to the land?” [It changes the size and shape of the land.] “Where would sand dunes be found?” [Where the wind is strong and steady.] “How do rocks affect blowing sand?” [The rocks acted as a shield.]
7. During the clean up save the sand for another experiment. The shoeboxes can also be used for the investigation in Lessons 6.
8. Help students to organize the concepts presented in Lessons 1 through 3 with a concept map. This can take the form of board or overhead work, or become a more permanent bulletin board with photos to help students integrate the work they have done. (For information on concept mapping, see the Teacher Background.) One possible scheme is:



**Assessment**

A photo of a sand dune and writing prompt is included in the Student Pages for a possible assessment.

**Application Beyond School**

Depending upon where you live, wind erosion may be a problem. Farmers know not to leave the soil barren and dry. Plants help stop wind erosion.

**Connections**

Social Studies

While studying wind erosion students can explore how the Dust Bowl in the early part of the 20<sup>th</sup> Century is an example of what happens to soil affected by wind erosion.

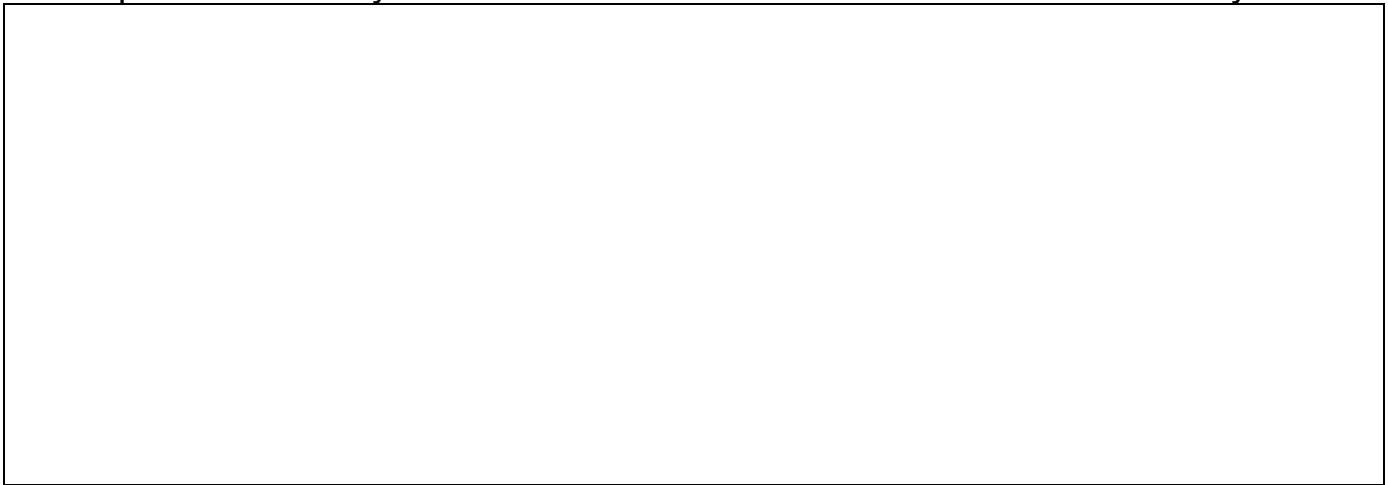
### Lesson 3: Thar She Blows!

**Problem:** What does wind do to soil and sand?

**Part I: Wind on loose sand.** This is a model. You are the wind. The sand in the shoebox is the soil. What do you think will happen to the sand if you blow it carefully through a straw?

**My Hypothesis:** \_\_\_\_\_

Draw a picture of what you think the sand in the shoebox will look like after you blow it.

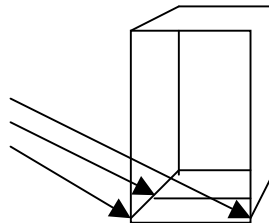


#### Procedure:

1. To make a wind box, each group should get a shoebox and draw a horizontal line across the short end of the shoebox about 1" from the bottom.

Cut along the line and up the two edges of the short side.

Cut here

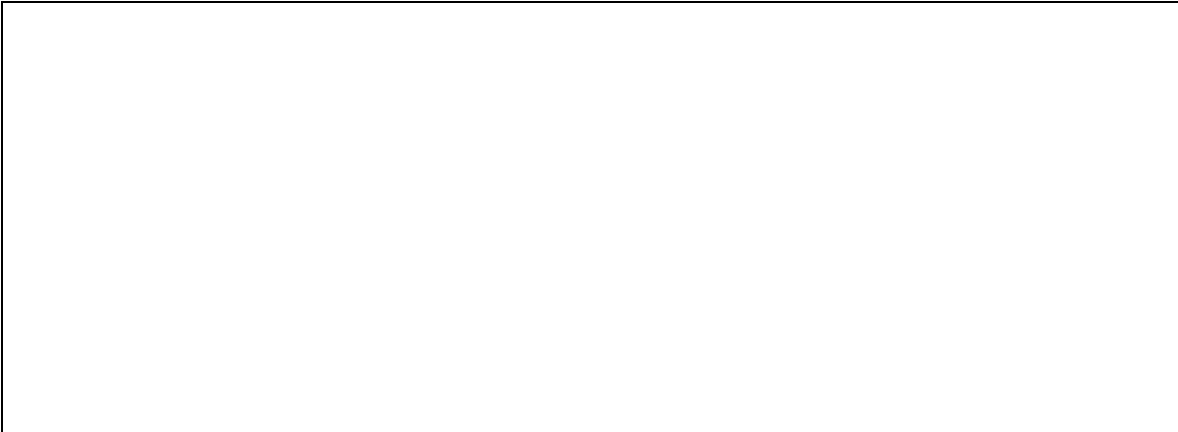


One of the short sides should now be taller than the cut side. Place the box on a desk or table. Put one cup of sand into the box. Spread it out evenly.

2. Take a drinking straw. Place one end on the cut edge of the shoebox. One student blows through the straw at the sand. (**Caution:** Wear safety goggles all the time. Blow carefully and slowly so the sand does not get into your eyes.) Blow for 30 seconds.
3. Take turns blowing the sand. The other members of the group observe the changes they see in the sand and draw them.



## My Observations



Was your hypothesis correct? \_\_\_\_\_

\_\_\_\_\_

**Part II: Wind on rocks and sand.** In this part you add three rocks to the sand.

**My Hypothesis:** \_\_\_\_\_

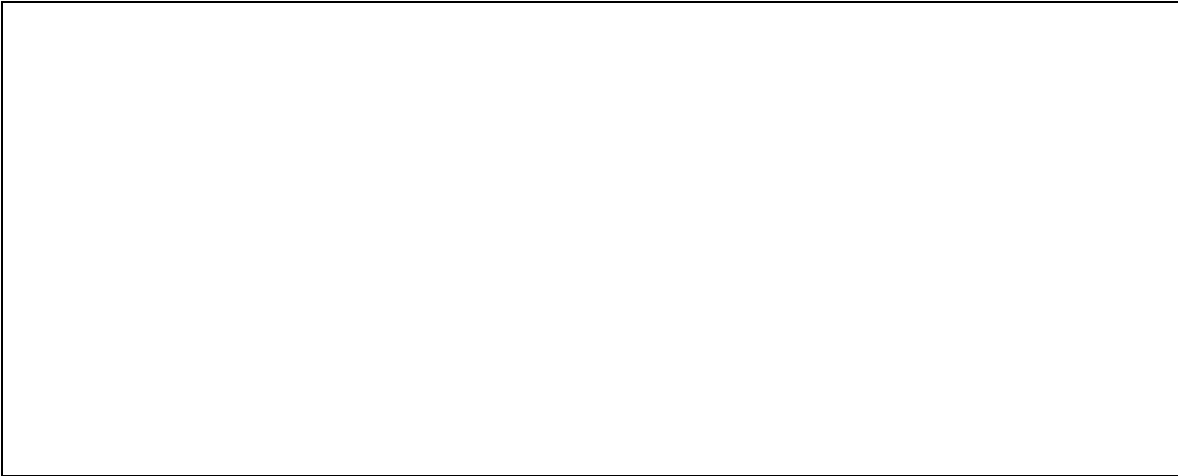
Draw a picture of what you think the sand in the shoebox will look like after you blow it.



**Procedure:**

1. Smooth out the sand. Add three rocks to the sand. Blow as before.

**My Observations**



**Conclusion:** How does wind change the surface of the earth?

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## A Picture Puzzle



This landform tells a story. Write a paragraph on what forces shaped this dune.

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## Lesson 4: Let's Get Dirty

### Big Ideas of the Lesson

- Soil is made up of humus, sand, silt, clay, and pebbles.
- Soil in different locations has different compositions.
- Minerals are substances formed in the earth.
- Bricks and concrete are examples of products made from earth materials.

### Abstract

In this lesson students examine the earth materials used in Lessons 1 through 3 and samples from other Michigan landforms, relating them to soil resources. They classify soils and associate minerals with their potential commercial use.

### Grade Level Context Expectation(s)

Students will:

- recognize and describe different types of earth materials (mineral, rock, clay, boulder, gravel, sand, soil, water, and air) (E.SE.03.13).

### Key Concept(s)

earth material

mineral

### Instructional Resources

#### Equipment/Manipulative

Characteristic (generic) sample made from:

1-cup black (loamy) topsoil

1-cup very small pebbles

Grass clippings, twigs, etc.

1-cup of sand

Clay (artist's, about 1/2 cup per group)

Hand lens (2 per group or station table)

Limestone (broken pieces from landscaping materials, 1 per group)

Newspapers (2 sheets per group or station table)

Paper cup (1 per group or station table)

Photos of commercial uses of Earth materials

Plastic grocery bags for each sample

Plastic spoons (1 per group or station table)

Soil/gravel sample taken from a riverbed

Soil samples taken from students' homes or schoolyard

Soil/sand mixture from Lesson 2

Toothpicks or coffee stirrers (1 per student)

#### Student Resource

Henderson, Janice, and Juliana Texley. *Supplemental Materials (SC03040401.doc)*.

Teacher-made material. Waterford, MI: Oakland Schools, 2009.

## Teacher Resource

Henderson, Janice, and Juliana Texley. *Grade 3 Unit 4 Teacher Background (SC030400TB.doc)*. Teacher-made material. Waterford, MI: Oakland Schools, 2009.

National Science Teachers Association. *Dig In: Hands On Soil Investigations*. Arlington, VA: National Science Teachers Association, 2001.

*Nile of the New World*. 14 March 2001. National Park Service. 17 July 2009 <<http://www.cr.nps.gov/delta/concept02.htm>>.

### **Sequence of Activities**

Advance Preparation: Ask students to bring in a cup of soil from their own yard. (If students live in apartments or in the city, make part of the schoolyard available for them.) Inform parents (and bus drivers) of the assignment. Caution them to have permission to dig up the soil and do not dig where there are waste products. Help students understand the importance of labeling their sample with the location and the date.

Mix a standard sample of soil for comparison. You may wish to purchase black potting soil with perlite rock. Collect a third sample from a riverbed. (This will be a collection of rounded rocks, pebbles, and sand of various sizes. You can also simulate this mix from samples of Michigan aggregate from a lawn and garden store, but must take care to choose rounded rocks and pebbles.)

This lab can be set up in two ways: Either give each group a sample of each type of soil, or set up samples of soils at stations around the room. (Two samples of four soils can be used for a four-station rotation.) In order to encourage thorough observation give students at least ten minutes per station or forty minutes to observe four samples.

Duplicate extra copies of full-page versions of “My Observations” to use in sorting soils. These will be discarded after students copy their observations into their own Student Pages. Make a transparency of the “My Observations” page for use with each sample as you discuss them in Part II (day two of activity, starting at Step 7).

This laboratory is divided into two parts, since the virtual fieldtrip and the observations will take at least a full (hour) period and the discussion and application another period.

1. Begin with another virtual field trip. Review photos or websites of the Grand Canyon and sand dunes. Then introduce new landforms for the students. Include a farm and the delta of the Mississippi River as well as other local landforms. Ask, “What processes might be happening here?” [Encourage students to recall the terms and concepts of Lessons 1, 2, and 3 by saying “weathering” and “erosion.” Do not expect too much specificity at this point.]
2. Ask students: “What if you could look at these sites with a very strong microscope? What would the soil look like?” [Encourage speculation.] Ask: “Imagine that you were a detective and you had a sample of soil from a mystery source. Could you tell whether soil came from a dune, a river, or a farm?” [Accept all answers at this point.]
3. Tell students that they are going to become detectives and examine soil samples. But before they do, they will have to agree on some common words to use in their descriptions. Ask them what words might describe the shape. (Triangular, square, rectangular, irregular, shaped like a \_\_\_\_\_, etc.) Put these terms on the board. Then remind students that soil does not just include rock.

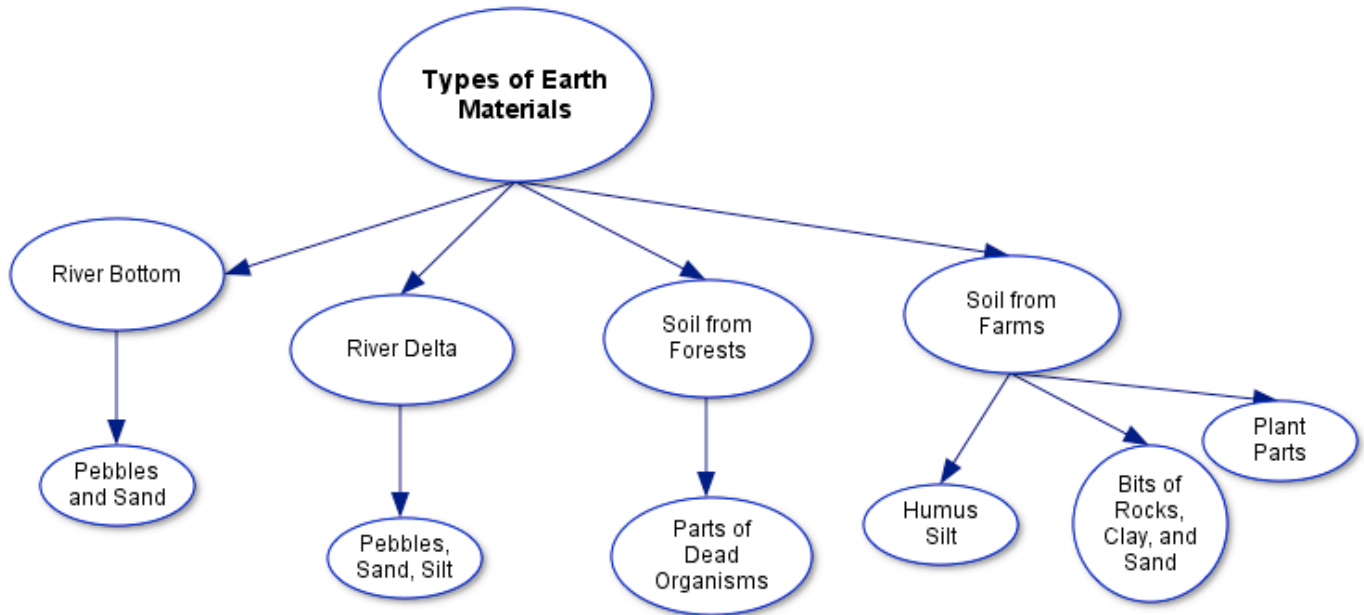
(Review Grand Canyon reading.) Rotten bits of plants, bugs, and animals are also in soil. (This material is called “humus” but the term is not necessary for this unit.) Ask: “What do you think rotting parts of living things would look like in soil?” [Black, mushy.] Say: “When you find these parts in soil, we will call them “humus.” Introduce students to the idea of particle size and the terms “sand,” “silt,” and “clay” to indicate particle size.

**Note:** Soil terminology is difficult because terms are used in several ways. To classify the particles in soil, we use the terms *sand* (for particles big enough to clearly see with the naked eye), *silt* (for those particles we can barely see with the naked eye), and *clay* (for those particles which are extremely small and invisible to the naked eye). While most Michigan sand is silicon dioxide (bits of quartz) the sand in Mexico is often ground up coral and shells, and on many volcanic islands sand is comprised of bits of lava rock. The term *clay* is also used for a specific mineral, aluminum silicate, which is found in very pure form in many areas of Michigan. Clay is gray, sticky, and holds a great deal of water. In this lesson most of the silt will be humus or black organic material.

4. Spread out the newspaper on the desks. Make sure each student team has samples of each soil. (If you are using the “station method” explain the timing system to students.)
5. Provide each group one classification form (a full-page version of “My Observations”) for each sample. Label the sections *sand*, *pebbles*, *clay*, and *silt*. Each team puts two spoonfuls of soil in the middle of the paper. Students begin to examine the soil materials and put the particles in the appropriate section.
6. When the soil sample has been separated, students should examine each type of component with a hand lens. On their own Student Pages, they should draw what they see and then record the relative percentage of each component in the sample as “A little” or “A lot.” (For example, for potting soil they would divide the mix into humus and pebbles, and then indicate that there is “a little” rock and “a lot” of humus.)
7. Clean up all areas. (If time does not permit completion of the entire activity in one day, this is a good place to break.)
8. Discuss student data for each sample. “Which sample had the most silt?” [Probably your mix, but schoolyards will vary.] “Which sample had the most pebbles or rocks?” [Probably riverbed, but schoolyards will vary.]
9. Show students some broken pieces of rock. (Driveway limestone works well.) Ask them if the pieces are rounded or sharp/pointed. [Pointed.] Ask students if the tiny bits of rock in their samples were rounded or pointed. [Probably rounded.] Ask: “Why are pebbles from a river bottom rounded?” [Weathering by wind and water.] Review the action of natural forces on earth materials using the concept map developed in Lesson 3.
10. Ask students: “What uses do we make of soils and earth materials?” [Brainstorm a long list that will include farming and mining uses.] Ask: “Which sample would be best for farming?” [This may be the potting soil sample or the schoolyard sample.]
11. Introduce students to a few photos of earth materials that you have collected (e.g., bricks, concrete, minerals, etc.). Ask students to bring in more photos for an earth materials bulletin board. Ask: “How do we get minerals out of the earth to use for these things?” [Mining, quarry.] Refer students to the picture puzzle in the Student Pages as a writing prompt.

## Assessment

Develop a new concept map with students, and have them begin to classify familiar forms of Earth materials under the title “Types of Earth Materials.” It could look like this:



## Applications Beyond School

Students can explore how gravel is sold by size in garden and farm stores. Sorting gravel is a technical skill that requires a state certificate.

## Connections

### Social Studies

While studying erosion and various types of earth materials, students can explore how the erosion of farmland is a major political problem as well as an environmental one; eroded farmland is often abandoned forcing displaced farmers into the cities.

## Lesson 4: Let's Get Dirty

**Problem:** What are the components of soil and dirt?

**Procedure:** Take two spoons of each sample. Put it on an observation sheet. Separate clay, humus, sand and pebbles. Draw each part of the soil. Then record whether the sample has "a little" or "a lot" of each component on an Observation sheet.

### My Observations

Sand	Clay
Silt	Pebbles



## Questions for Discussion

1. Which sample had the greatest amount of silt? \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

2. Which sample had the greatest amount of pebbles and rocks? \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

3. Why are pebbles from a river bottom rounded? \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

4. Which sample would be best for a farm? \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

## A Picture Puzzle



Here is some dirt from a student's yard. What can you tell about the dirt?

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## Lesson 5: Earth Power

### Big Ideas of the Lesson

- Volcanoes are openings in the earth's surface through which melted rock, ash, and gases are forced out.
- Magma is molten rock below the ground.
- Lava is melted rock that erupts from a volcano.
- Lava and ash from a volcanic eruption change the surface of the land.

### Abstract

In this lesson students expand their understanding of the forces that change earth's surface and by exploring the power of volcanoes. They examine the changes caused by volcanic eruptions and identify the materials formed from magma.

### Grade Level Context Expectation(s)

Students will:

- recognize and describe different types of earth materials (mineral, rock, clay, boulder, gravel, sand, soil, water, and air) (E.SE.03.13).
- identify and describe natural causes of change in the earth's surface (e.g., erosion, glaciers, volcanoes, landslides, and earthquakes) (E.SE.03.22).
- develop strategies and skills for gathering information about earth materials and for problem solving the various natural causes of change in the earth's surface (S.IA.03.14).

### Key Concept(s)

earth material

natural change

### Instructional Resources

Equipment/Manipulative

Photo of Pompeii

Pictures/articles on volcanoes (web access is preferred)

Volcanic pumice (available as "lava rock" in garden stores)

Student Resource

Henderson, Janice, and Juliana Texley. *Supplemental Materials (SC03040501.doc)*.  
Teacher-made material. Waterford, MI: Oakland Schools, 2009.

Kalman, Bobbie. *Volcanoes on Earth*. New York: Crabtree Publishing, 2009.

Vesuvius, Italy. Volcano World. 17 July 2009

<[http://volcano.oregonstate.edu/volcanoes/volc\\_images/img\\_vesuvius.html](http://volcano.oregonstate.edu/volcanoes/volc_images/img_vesuvius.html)>.

#### Teacher Resource

Volcano Video National Geographic:

<http://video.nationalgeographic.com/video/101-videos/volcanoes-101>

Bunce, Vincent. *Restless Planet Series: Volcanoes*. White Plains, TX: Steck-Vaughn, 2000.

Henderson, Janice, and Juliana Texley. *Grade 3 Unit 4 Teacher Background (SC030400TB.doc)*. Teacher-made material. Waterford, MI: Oakland Schools, 2009.

Mt. Hood. 15 April 2008. United States Geologic Survey. 17 July 2009

<<http://vulcan.wr.usgs.gov/Volcanoes/Hood/Locale/framework.html>>.

PNSN Webicorder Display for Schools. United States Geologic Survey. 17 July 2009

<<http://www.ess.washington.edu/SEIS/PNSN/WEBICORDER/PNSN/welcome.html>>.

Wright, Russell. *Volcano! An Event-Based Science Module Student Edition*. White Plains, NY: Dale Seymour Publications, 1997.

#### **Sequence of Activities**

Advance Preparation: Student interest in archaeology is at a high, due to the popularity of the Disney movie *Atlantis*. (If students are discussing it, you may want to use this discussion in your anticipatory story.) Ask the librarian or media specialist at the school or local community library to gather any information on volcanoes for you. (The information should be readable for upper elementary students. If the information is only in encyclopedias, then the students may have to go to the library for part of this lesson. Preview and bookmark the website on Mt. Hood. This exercise uses a modified KWL approach to informational reading.) **Note**: If you choose to do a model volcano demonstration, do not use directions from old books that involve ammonium dichromate.

1. Volcanoes are often the object of dramatic movies and cartoons. Begin by exploring students' prior knowledge on the subject on the Student Pages. (Brainstorm, asking about travels and movies they have seen.)
2. Say: "You may have seen volcanoes on the movies. But we seldom see their damage." (Go into story mode.) "Once there was a bustling city in southern Italy called Pompeii. It had thousands of people. They could see the shadow of a large mountain, Vesuvius, from the city, but it had never hurt anyone that they could remember. Then one day in 79 AD the mountain erupted. Suddenly the whole city was covered with ash and hot lava. People were covered instantly. Not a single person escaped the city. Today Pompeii is very interesting to archaeologists, because we can see exactly how everyday people lived almost 2000 years ago." (Show website or the photo found in the Teacher Background.)
3. Ask students to think of one question they want to know about volcanoes and write it on the Student Pages.
4. Introduce students to the questions on the Student Pages. Have them add some of their own questions. Tell students that now they can search for the answers and determine how well their

prior knowledge matches what it really true. Prior knowledge is the information students come to class already knowing. They write their researched answers in the “Research “ column.

**Note:** If you have some students that will just write an answer because they think they know it, have those students write down the page numbers or URLs along with their answers. If resources are limited or the class has difficulty researching, put students into small groups. The smaller the group, the better chance each student has to research. If students are in small groups have them take turns reading to the other members. Assign jobs to each student. The number of jobs depends upon the number of students in each group. One member can be the reader, one the recorder (takes notes), one the task master (keeps the group focused and reminds members to use a quiet voice), and one the reporter (shares the information learned with the rest of the class). These jobs can change every five minutes to give everyone a turn. You should decide if you think your class would find this last suggestion disruptive or helpful.

5. Have students log into the website and/or look through books or magazines. If a video is available, then the whole class should watch it together. (**Note:** At this age, it is difficult for students to take note. You can have the students watch the video once where you keep stopping it at important places so they can take notes and/or watch it a second time straight through so students can get the big picture and sequence the information.)
6. Once everyone has an opportunity to research the answers, share them as a whole class. After each question, ask those students who are the *reporters* if another group found additional information or contradictory information. Discuss all answers.
7. Distribute pieces of pumice to each student or small group. Ask students to note as many physical characteristics as possible. Encourage them to note its density (by comparing its weight to another rock the same size) and the holes in the surface. Say: “How do you think such a rock was made?” [This is not easy, but encourage students to think of bubbles, a baked cake, or foam.] Say: “Imagine that rock material (magma) was so hot that it was a sticky liquid and then it suddenly cooled. What would it look like?” Ask: “How can you tell that this rock was made in a place that had great heat and pressure?” [Holes, evidence of melting, air.] Say, “This is volcanic rock. It is not the only kind of volcanic rock. Sometimes a volcano sends out smooth, liquid lava that hardens like glass. At other times, the volcano erupts with great amounts of gas and this rock is formed.” Ask: “What would be a good use for this rock?” [It is used in barbeques because it resists heat, and is used on gardens because it is relatively light.]
8. Ask: “Are there any dangerous volcanoes today?” Students may be aware of volcanoes in the news. Take advantage of current events. Then show or tell students about the Webcam site (see above) where elementary schools help the United States Geologic Survey monitor the action of volcanoes and earthquakes. If possible, check the site at the school computer lab or in your room if you have access.

### **Assessment**

Students show understanding through the information they write in the “Research” column. Answers to questions: Question #1: Magma is the molten rock below the ground. When it goes above the ground, it is lava. Question #2: The magma is always under the ground. Heat and pressure continuously build up under the ground. When the magma finds a crack or can work its way near the surface of the earth, it erupts and the magma pours out as lava. Question #3: Volcanoes can: erupt

lava that hardens into rocks on the surface of the earth or ocean floor; send out lots of ash covering the ground with a new layer of material; displace and fill in lakes causing water to erode other lands; cause a side of the mountain to come crashing down. Question #4: People use volcanic mud as a facial. Pumice is a common garden rock. Quartz and other igneous rocks have commercial value. Question #5: Scientists and volcanologists use computers to predict when volcanic eruptions will occur. Scientists can wear special heat suits to study the hot lava flows. NASA has invented an eight-legged robot with a camera that can take digital pictures.

### **Application Beyond School**

The easiest access to igneous rock in Michigan is in the far western Upper Peninsula. This area is called the continental shield, because it contains some of the oldest rocks on the continent. Trip photos or travel guides may help students understand how different the geology of the Upper Peninsula is from the Lower Peninsula.

### **Connections**

#### English Language Arts

While studying volcanoes, students can read or use their viewing skills to gain further information. Students can also practice note-taking skills.

### Weblinks for Kids Research:

Science Kids : <http://www.sciencekids.co.nz/sciencefacts/earth/volcano.html>

National Geographic: <http://kids.nationalgeographic.com/explore/science/volcano.html>

Weather Wiz Kids: <http://www.weatherwizkids.com/weather-volcano.htm>

KidsGeo.com: <http://www.kidsgeo.com/geology-for-kids/0054-volcanoes-landforms.php>

Scholastic: <http://teacher.scholastic.com/researchtools/articlearchives/volcanoes/>

Volcano World: <http://volcano.oregonstate.edu/glossary/1>

Fireplacespot.com: <http://www.fireplacespot.com/kids-volcano-facts>

Discovery Kids: <http://discoverykids.com/games/volcano-explorer/>

## Lesson 5: Earth Power

What do you know about volcanoes? \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Research these questions and one of your own. Write down your prior knowledge first.

Question	Prior Knowledge	Research	Source
1. What is the difference between magma and lava?			
2. Why does a volcano erupt?			
3. Name three ways a volcano can change the surface of the land.			
4. Name and describe two ways people use the materials that come from a volcano.			
5. What two technologies have scientists invented to allow them to study volcanoes?			
My Question:			

Pumice is a rock made in volcanoes. Draw it here and put down as many observations about its physical properties as you can.



**My Observations**

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## A Very Old Story

Archaeologists often must dig many years to find just a few clues about an ancient city. But one special find amazed the scientists—An entire city frozen in stone.

In 79 A.D. Pompeii was a busy port in the Roman Empire. The city had many homes and shops. People from all over the world gathered there.

The Romans were great builders. Pompeii had many buildings that would seem quite modern. They had indoor bathrooms and swimming pools. Their homes were heated with hot air vents like ours. The roads were well paved.

The people of Pompeii were so wealthy they thought nothing would happen to them. Even when they heard nearby Mount Vesuvius rumble, they did not run away.



Then one day, the volcano erupted. Ash fell on the city and buried every person and animal in Pompeii. They were buried so quickly that many were still busy doing their work. The entire city—every person, pet, tool and treasure—were frozen in stone for us to study today.

## Lesson 6: A Whole Lot of Shakin'

### Big Ideas of the Lesson

- An earthquake is the shaking of part of the earth's surface caused by movement deep within the earth.
- Large sections of the earth's crust slide past one another deep inside the earth.
- Heat and pressure pushes the ground up.
- A seismograph is an instrument used to measure the strength of earthquakes.

### Abstract

In this lesson students explore how earthquakes can also change the form of the land. In this exercise they research earthquakes and simulate an earthquake with paper to study the effects.

### Grade Level Context Expectation(s)

Students will:

- identify and describe natural causes of change in the earth's surface (e.g., erosion, glaciers, volcanoes, landslides, and earthquakes) (E.SE.03.22).
- develop research strategies and skills for gathering information about earth materials and for problem solving the various natural causes of change in the earth's surface (S.IA.03.14).

### Key Concept(s)

earth material  
natural change

### Instructional Resources

Equipment/Manipulative

Paper (two sheets per student)

Student Resource

Henderson, Janice, and Juliana Texley. *Supplemental Materials (SC03040601.doc)*.  
Teacher-made material. Waterford, MI: Oakland Schools, 2009.

Kalman, Bobbie. *What Shapes the Land?* New York: Crabtree Publishing, 2009.

Teacher Resource

*Cool Earthquake Facts*. 14 April 2009. USGS: Earthquake Hazards Program. 17 July 2009 <<http://earthquake.usgs.gov/learning/facts.php>>.

Henderson, Janice, and Juliana Texley. *Grade 3 Unit 4 Teacher Background (SC030400TB.doc)*.  
Teacher-made material. Waterford, MI: Oakland Schools, 2009.

Planetary Photojournal. NASA. 17 July 2009 <<http://photojournal.jpl.nasa.gov/>>.

San Andreas Fault. 5 May 1999. United States Geologic Survey. 17 July 2009 <[http://pubs.usgs.gov/publications/text/San\\_Andreas.html](http://pubs.usgs.gov/publications/text/San_Andreas.html)>.

### Sequence of Activities

1. Review the changes in the land caused by water and wind [erosion], ice, wind, and rain [weathering], and volcanoes [energy from deep in the earth]. Show students a picture of the San Andreas Fault (USGS) and ask them to develop a hypothesis about what they see and what forces caused that change.



2. Tell students that today they will study another force that changes the land. This force is called an earthquake. Pass out the KWL Student Page. Ask students to think about what they already know about earthquakes and how they change the land. Perhaps they have read something. Perhaps they have seen movies of earthquakes. Perhaps they have relatives in California who experience earthquakes. If they are absolutely sure of the fact, they list it under *What I Know*. (Allow about five minutes.) Ask students to share what they think is true about earthquakes. Make a class KWL chart on the board. Record their responses. (See example below.)

What I Know	What I Wonder	What I learned
The information that the students share in the initial discussion goes here.		

3. List what the students share in the *What I Know* column. Keep this information posted. You will refer to it later in the lesson. (**Note:** Students might have seen movies that show earthquakes as giant cracks that split the Earth and cause buildings and cars to fall into the cracks. Though this is a misconception, accept all answers at this point.)

4. Now ask if all the statements listed on the class KWL chart, under *What I Know* are definitely true. Are there any that might not be true? Are there any that they wonder about? (**Note:** Caution students not to attack the knowledge of the student who shared. Rather their prior knowledge might not cause them to reach the same conclusions.) Those questionable statements are written in the *What I Wonder*

column. Ask them if there are any other questions they have about earthquakes and how they change the land. Discuss their questions as a class. Listening to each other helps students generate other questions. Ask them to put three questions or questionable statements on their own chart. Students list those questions in the *Wonder* column.

5. Ask about three or four students to share their questions with the class. If students are reluctant to share, encourage them by telling them that the best learners are those that think of questions before research. Thinking of questions gives them a purpose for reading. Record those questions on the KWL chart. (**Note:** If students do not have at least three questions on their chart, have them copy the class chart.)
6. Assign the reading on earthquakes in the Student Pages. Have students do the earthquake simulations.
7. After they have read the pages, ask them to check what they wrote in the *What I Know* column. Are there any statements that they wrote that are mentioned in the article? Which ones are true that they wrote? Are there any they thought to be true and actually are not? Is there any information that they learned from the sheet that answers any of their questions? That new information is recorded in the *What I Learned* column. Ask a few students to share. Check the class KWL chart. Did anyone find out an answer to one of the class questions? If so, that information goes in the *Learned* column.
8. Pass out any trade books, articles, pictures, etc. you have collected about earthquakes. Remind the students that they are looking for answers to the *Wonder* questions. If it is a book, ask the students if they are going to read every page and word or is there a more efficient way to locate a possible answer? (Use the Index in the back of the book. If there is no Index, then the Table of Contents is another option.) Allow about 15-20 minutes depending on the attention span of the class and the number and kind of resources available. Record all answers in the *Learned* column.
9. When this part of the research is completed, ask a few students to share something they learned. Ask if anyone found the answers to any of the class questions. If so, record them on the class KWL chart.
10. Assign the student reading on "Landforms on Other Planets" and discuss the answers to questions. [Volcano calderas are surrounded by concentric rings. Meteor craters have small rises in the center from elastic spring of the melted rock, and ejecta splashes around them. The canyon on Mars was caused by water erosion; it meanders and has branches. The cracks on Europa are straight, and are caused by planetary tectonics. On the photo puzzle, you can see tectonic cracks and craters with ejecta on the surface of Miranda.]

**Assessment**

Introduce a new photo of a distant planet from the planetary photo journal. Students should be able to identify water erosion, volcanoes, craters, and tectonic earthquakes.

**Applications**

Earthquakes very rarely happen in Michigan. Students can search the Internet for the San Andres Fault. They can look at a map that shows where earthquakes are most likely to occur and determine how far the closest spot is to Michigan.

**Connections**English Language Arts

While investigating earthquakes, students can use a KWL chart as a good graphic organizer and technique to organize information.

**Kid's Research Web links:**

Science Kids: <http://www.sciencekids.co.nz/sciencefacts/earth/earthquakes.html>

Weather Wiz Kids: <http://www.weatherwizkids.com/weather-earthquake.htm>

USGS : <http://earthquake.usgs.gov/learn/kids/>

Fun Facts for Kids: <http://www.fun-facts.org.uk/earth/earthquakes.htm>

Earthquake Facts: <http://www.earthquakefacts.net/Interesting-Earthquake-Facts.html>

Dialogue For Kids: <http://idahoptv.org/dialogue4kids/season12/earthquakes/facts.cfm>

## Lesson 6: A Whole Lot of Shakin'

**My Hypothesis:** (What caused the landform?)

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### A KWL Exercise

Write what you know to be true about this statement in the first column.

Write what you wonder about or are not sure of in the second column.

Write what you learn in the third column.

What I Know	What I Wonder	What I Learned

## Earthquakes

The surface of the earth is constantly changing. Water, wind and volcanoes move earth materials. There is another force that causes change. It is an earthquake. An earthquake is a movement of the earth's crust.


The earth's crust is made up of the land and oceans. Below the crust layer of the earth, below the oceans, below the deepest cave, the earth is very hot. Molten rocks called magma are churning, producing pressure. This heat and pressure cause sections of the earth far under the ground and on top of the magma to move. Sometimes we can feel this movement.

Earthquakes often begin deep in the earth, as large sections of crust slide past one another. They move the rock above. Remember the picture of the Grand Canyon? Look at the layers of the rock. Most of the layers are straight across and parallel to each other. Look closely for other layers that are slanted. They are slanted because the heat and pressure inside the earth pushed the ground up. The Rocky Mountains in western United States were formed this way.

Sometimes magma finds the crack and forces its way up and out of the crack. A volcano often forms in an area where there are many earthquakes. Other times, water passes over hot magma and seeps toward the surface as steam. We call these steam vents geysers. Old Faithful in Yellowstone Park is a famous American geyser.

Scientists have invented technology that helps them better predict when earthquakes might occur. The seismograph machine detects the slightest movement in the earth's crust. Scientists can also measure the amount of force the earthquake has.

Here is a demonstration that can help you understand how earthquakes change the land:

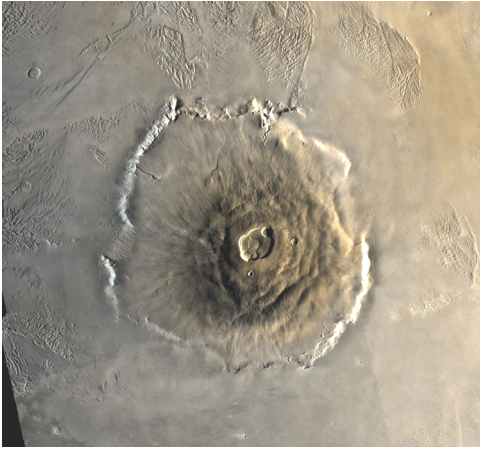
- Take two sheets of paper. Place them next to one another in the same position you would use to write on them. Draw some layers of rock across both papers, so that they look like one large rocky plain.
- Hold the papers about 2 cm apart from each other. Place your fingertips near the outer edges farthest away from each other. Slowly push the two papers closer together. When they touch notice what happens. One paper should slide under the other paper. This is an example of subduction. If these were really rock layers, what would happen to the layer on top?
- Leave the two papers with one on top of the other along one edge. Now move them up and down slightly. This movement is like an earthquake. What would the land look like after the layers moved?
- Take one paper and fold it about 4 cm from the long edge. Unfold it. Smooth it out. The fold should look like this: 
- Place your fingertips near the outer edges farthest away from each other. Slowly push the two papers closer together. On a much bigger scale, this is how mountains form.

Now that you have read the information and done the simulation, go back to your KWL sheet and fill in any information that helps you answer your questions. Use good references to find the answers to other questions you have on your sheet.

## Landforms on Other Planets

A geologist studies changes on the Earth's surface. A planetologist looks at views of far away bodies in space and tries to learn from them in much the same way.

Volcanoes on earth release heat and pressure changing the surface of our planet. Volcanoes on other planets do the same thing. The largest volcano on Mars Olympus Mons is over 1600 kilometers (1000 miles) across! Can you tell it is a volcano? Look for the caldera (crater) in the center and the layers of lava that have poured out.

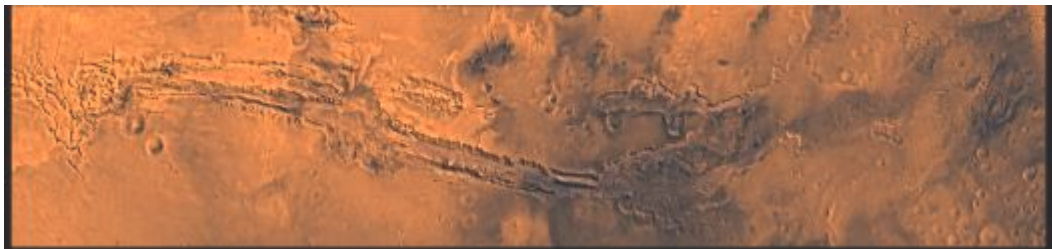


Compare that crater to a large crater on the Moon. The moon has no volcanoes. The craters are caused by meteors. Can you see the difference? Look at the crater on the top of the moon photo.

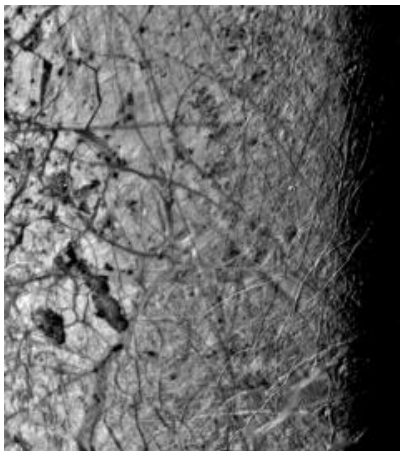
Can you see splashes? That shows the dust and rock that was thrown out of the crater by the meteor. If you look closely you can also see a little hump in the middle of the meteor crater. This is where the rock melted on impact bounced back up.



Other planets have erosion, too. We know that there was once water on Mars because we can see the erosion it caused. Look at Valles Marineris.



It is over 3000 kilometers long and eight kilometers deep, like the Grand Canyon. How can you tell that it was formed by water?



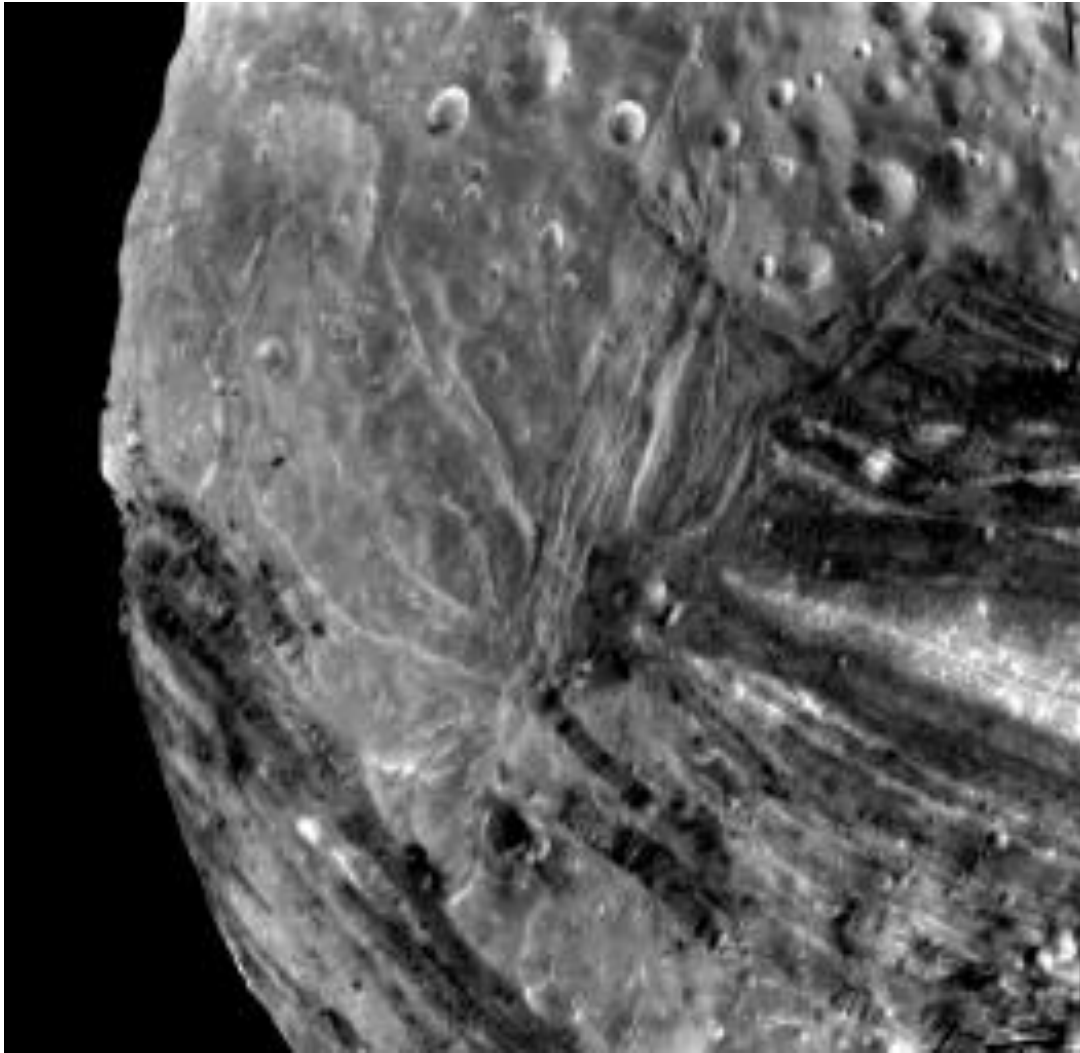
Cracks from earthquakes look different. They are straighter and don't branch. Look at this picture of Europa, a moon of Jupiter. How are its cracks different from the dry riverbeds of Mars? Can you tell that Europa is covered by ice?

So if you want to learn about other planets, start by studying right here on earth.



## A Photo Puzzle

This is Miranda, one of the moons of Uranus. What landforms can you see there?



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## Lesson 7: Glaciers On The Move

### Big Ideas of the Lesson

- A glacier is a large mass of ice made from compacted snow.
- Glaciers carry rock and soil to other places as they move across the land.
- An ice age is a long period of time when glaciers covered large parts of the earth.

### Abstract

In this lesson students discover how glaciers have shaped much of the land in Michigan. As the ice melted and receded northward, it scraped the top layer of soil and rocks and carved giant cavities in some parts of the land. Students simulate this phenomenon by observing an ice cube on sand. Then they take a short walk or field trip and look for evidence of glacial action.

### Grade Level Context Expectation(s)

Students will:

- identify and describe natural causes of change in the earth's surface (e.g., erosion, glaciers, volcanoes, landslides, and earthquakes) (E.SE.03.22).

### Key Concept(s)

natural change

### Instructional Resources

#### Equipment/Manipulative

Crayons or colored pencils

Elevation map of Michigan

Elevation map of the United States (one per group) with glacial limit defined

Ice cube

Painting pan for rollers with a three-centimeter hole or notch cut in the center of the short end where the bottom meets the side edge

Radiant Heater

Sand (2 cups per student)

#### Student Resource

Henderson, Janice, and Juliana Texley. *Supplemental Materials (SC03040701.doc)*. Teacher-made material. Waterford, MI: Oakland Schools, 2009.

*Shrinking Glaciers*. Ed. Emily Sohn. 14 September 2005. ScienceNews for Kids. 17 July 2009 <<http://www.sciencenewsforkids.org/articles/20050914/Feature1.asp>>.

#### Teacher Resource

You Tube: What is a Glacier? Facts and Information  
<http://www.youtube.com/watch?v=6YMJBnpwsNQ>

You Tube: *What is a Glacier?* <http://www.youtube.com/watch?v=k6gk1b4ACP0>

*All About Glaciers*. National Snow and Ice Data Center. 17 July 2009 <<http://nsidc.org/glaciers/>>.

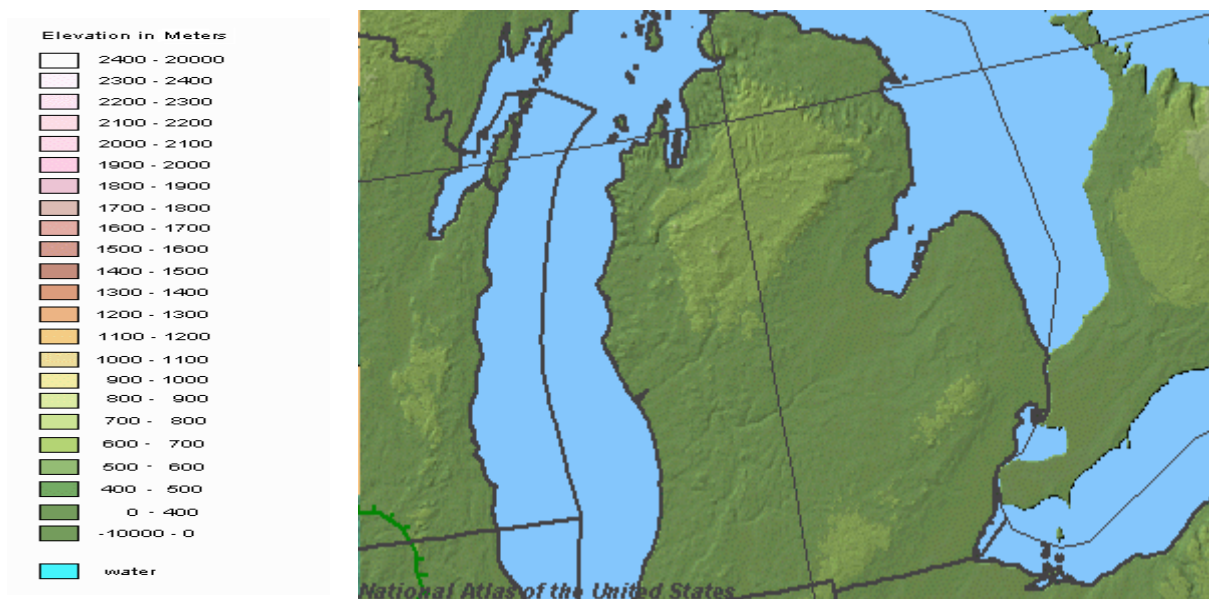
Gordon, John Ewart. *Glaciers*. Stillwater, MN: Voyageur Press, 2001.

Henderson, Janice, and Juliana Texley. *Grade 3 Unit 4 Teacher Background (SC030400TB.doc)*. Teacher-made material. Waterford, MI: Oakland Schools, 2009.

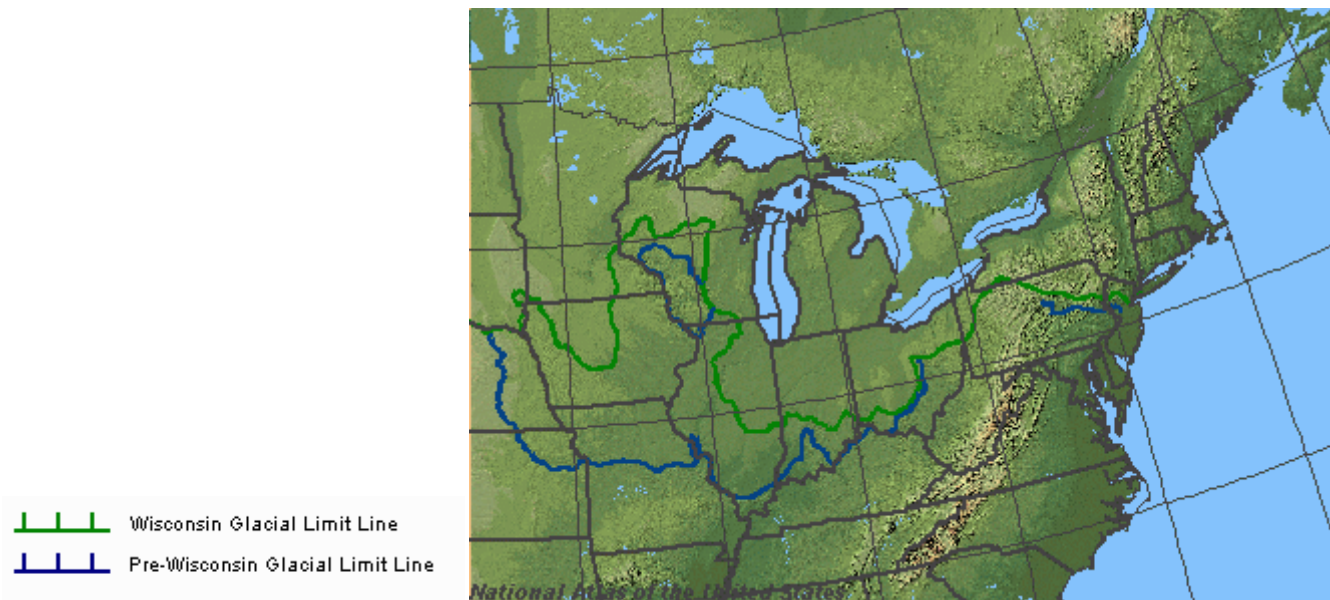
*National Atlas of the United States*. 17 July 2009 <<http://nationalatlas.gov/natlas/natlasstart.asp>>.

### Sequence of Activities

Advance Preparation: If your school does not have good relief maps, go to the National Atlas of the United States website listed above. There you can generate maps of every kind. For example, by requesting topography you can generate an elevation map of Michigan.



You can also generate the entire United States. This map has a line that defines the lower boundaries of glacial movement for two ice ages. Print this map for student groups.



Ask the students to think of four natural ways changes can occur in the earth's surface. [Wind, water, volcanoes, and earthquakes.] If you have maintained a bulletin board, use it to discuss processes studied in the unit. Tell them that sometimes these ways act together. For example, water and wind can act on the earth's surface and cause erosion and weathering. Tell them that is one more way. Ask if anyone can think of another way. If they do not have an idea, tell them that this other way helped form much of Michigan at the end of the Ice Age. [Glaciers.] Ask students if they know what a glacier is or how it is formed. Write their definitions and causes on the board. Tell them that a glacier is formed when snow comes down and begins to get deep. It gets deeper and deeper. It builds up in layers. If the snow doesn't melt before the next cold season, it is called a glacier. The bottom layers of snow get packed down and the pressure causes it to turn to ice. A glacier can build for thousands of years. It is so heavy that its mass presses down and melts a thin layer underneath the massive snow pile, allowing the glacier to slide across the land.

1. Now tell them that they are going to investigate how glaciers change the land. Pass out the Student Page, *Glaciers On the Move*. Divide the class into groups of four. Read over the sheet with the students so they understand what they will be asked to do. Ask them to put the directions in their own words and share with the group. Ask one student to share what the group said. Make sure the sequence is correct.
2. When you are sure the students understand the directions, have one student from each group come up and get all the materials except the ice cube.
3. Have the students set up the experiment. You can mound the sand slightly to increase the speed of the ice cube's movement. (**Caution:** Heat lamps are not recommended because tiny drops of cold water can make a bulb shatter. Use a radiant heater or sunlight.) As you check to make sure each group has set up the investigation correctly hand each group an ice cube. They can begin the investigation. One student in each group should be the reader and reread the investigation as another student does each step.

4. Direct them to the reading in their student pages. After about 15 minutes have students make a detailed drawing of what they observe. [Besides the fact that the ice cube is smaller, they should notice that the ice cube is dirty.] After the ice cube is melted, ask students to compare the sand under the block of ice with the sand that was not under the ice.
5. Ask them to think of another question they would like to investigate that is related to this investigation. Besides the question they write a short description of how they would conduct the investigation. Clean up all materials. Discuss the questions.
6. Refer students to the geologic map of the north central states, including Michigan and Ohio. Ask students to darken the line that shows the Wisconsin Glacial Limit. Ask: "What do you see above this line? What differences are there below it?" [The topography is flatter where the glaciers have been.] "What natural feature roughly follows the line?" [The Ohio River.] Ask students how they would expect the soil to be different above and below the line. [More gravel where the glaciers have passed. More mountainous and rougher terrain where there were no glaciers.]
7. Take students on a virtual or photographic field trip of your own community. You probably have landforms caused by glaciers in your area, which students will now be able to recognize. Use a digital or film camera to bring pictures into your classroom. Some possibilities include:
  - Glacial till is an unsorted mixture of silt, clay and small rocks, which is basically what covers most of Michigan.
  - Kettle lakes are tiny lakes (often clustered), which resulted when the ice began to melt, but blocked the drainage of part of its mass.
  - Moraines are large, long hills of till which developed along the edge of a glacier as it stayed in one spot. (The edge melted and accumulated gravel accumulated in ridges.)
  - Drumlins are smaller, long tapered hills with gravel and rock deposited in the same way.
  - Eskers are long, thin winding ridges deposited by a river formed by glacial melt.
  - Kames are small round dome shaped hills formed when a lake (hole) melted inside a glacier.
  - Glacial erratics are large rocks of a type not found anywhere near, which have been carried by glaciers and deposited far from their point of origin.

If students live near Mackinac Island, they may also wish to research the "wedding cake" structure of the island. Each "layer" is another geologic period and ice age.

### **Assessment**

Students should show understanding of the objective in their discussion and on their worksheet. The following writing prompts can evaluate understanding:

1. In the middle of a Michigan farmer's field there was a large, round granite boulder. The farmer knew that granite was an igneous rock, found in young mountains like the Rockies. There were no mountains near his home. Can you help him understand how the rock could have come there? [Glacial erratic.]
2. Michigan and Minnesota are famous for their lakes. In many areas there are many small lakes and ponds. Most have gravel shorelines. You cannot find lakes like these in Georgia or Alabama. Can you explain the lakes? [Kettle lakes.]
3. Many hills in Michigan are mined for gravel. But gravel is almost never found in the southern states, and most must be trucked in from northern states. Can you explain? [Glacial till.]

### **Application Beyond School**

Michigan was formed by glacial action. Students take a walk to see evidence. They can bring in Michigan vacation pictures of hilly areas or lakes they have visited with their families. A geologic map of the community with photos makes a great parent night display.

### **Connections**

#### Social Studies

While studying about glaciers, students can read an elevation map of Michigan and the United States.

### **Kids Research Web Links:**

National Geographic: <http://www.ngkids.co.uk/did-you-know/Glaciers>

Science Kids: <http://www.sciencekids.co.nz/sciencefacts/earth/glaciers.html>

## Lesson 7: Glaciers On The Move

**Problem:** How do glaciers change the land?

**My Hypothesis:** \_\_\_\_\_

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### **Procedure:**

1. Collect all your materials. Put a bucket under the hole in the pan.
2. Pour the sand near the highest end of the pan. Mound it slightly like a hill. Try to get the sand as smooth as possible.
3. When your teacher has checked your set up, place the ice cube on just over the top of the hill. It looks like a sled ready to go down.
4. If you have a heater, plug it in point it in the direction of the ice cube. Or put your setup in the sun. After five minutes, roll your ice cube once. Do this again after another five minutes.
5. Look carefully at the sand around the ice cube. Look carefully at the ice cube. Make a detailed drawing of the ice cube on the sand.
6. Sometime through the investigation, your teacher will tell you to make another detailed drawing. Do you see any changes from your first drawing? Include these changes in your second drawing or describe the changes.
7. After the ice cube is melted, make a third drawing. Look carefully at the sand that was under the ice cube and the sand that was not under the ice cube. Was there a difference? Draw or describe what you observe.

Sequence	Detailed Drawing
<b>Beginning</b>	
<b>Middle</b>	
<b>End</b>	

**Conclusion:**

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This investigation makes me think of another question to investigate:

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## Glaciers on the Move

Each winter it snows on most of the Earth except the tropics. In the far North and far South the snows accumulate. But in the spring, the Sun returns. Almost all the snow that falls melts before the next year.

But there have been many times in Earth's history when that was not true. The climate got just a little colder each year. More snow fell than melted. After many years, massive mountains of heavy snow called *glaciers* formed over much of the land.

In the United States we know there have been four of these cold periods since the time of the dinosaurs. They were called *Ice Ages*. The most recent Ice Age ended only about 10,000 years ago.

During the ice age the glaciers grew and spread until they covered the land. In the United States, they moved as far south as the Ohio River. As the Ice Mountains moved, they crushed everything in their path. Large rocks became gravel, and hills were flattened.

Most of the land animals moved south during the Ice Ages. Many had to face new enemies in the more crowded lands, and some went extinct. Other animals adapted to the cold by growing thick coats and massive bodies.



However, the world did not stay cold. Eventually the temperatures got a little warmer each year. The ice melted and the glaciers moved north. On the edge of the giant ice mass, water began to run. With it came all the sand and gravel that the glacier picked up as it moved south. Like a giant litterbug, the glacier left long, narrow hills of gravel in its wake.

The glaciers did not move quickly or steadily. Sometimes they stopped, melting giant puddles that became small lakes. Looking at a map of a Midwestern state, you can often see these blue patterns.

Think of the glaciers as you drive through Michigan. They left many clues behind.

### 3rd Grade the Earths Surface, Unit A

**Promethean flip** chart to go with the unit -  
Rock and Earth

<http://www.prometheanplanet.com/en/Resources/Item/30373/rock-and-earth#.U8MiTvldUik>

Weathering and Erosion

<http://www.prometheanplanet.com/en/Resources/Item/42634/weathering-and-erosion#.U8MtVvldUik>

Landforms - Forces that shape the land. <http://tinyurl.com/l35338v>

NIE - GZ Rumbling Grumbling Volcanoes <http://tinyurl.com/leaffxv>

#### **Websites**

Smithsonian Collecting: Rocks and Minerals (website with neat information about collecting rocks and minerals. <http://www.smithsonianeducation.org/idealabs/collecting/main.html>

How a Fossil Forms: web book with audio

[http://www.harcourtschool.com/activity/science\\_up\\_close/306/deploy/interface.html](http://www.harcourtschool.com/activity/science_up_close/306/deploy/interface.html)

New Jersey - Tour at Sterling Hill Mine Museum (interesting clip of minerals in a mine)

[http://www.mineraltown.com/videos/sterling\\_hill\\_museum.htm](http://www.mineraltown.com/videos/sterling_hill_museum.htm)

Mining Map of the United States <http://www.msha.gov/KIDS/MINING.HTM#.U8MqAPldUin>

Mineralogy for Kids (great place to learn about rocks) <http://www.mineralogy4kids.org/>

Interactive Rock Cycle and Rock Collecting <http://www.learner.org/interactives/rockcycle/>

The Rock Cycle <http://www.cotf.edu/ete/modules/msese/earthsysflr/rock.html>

Agent Erosion, Aims Lesson:

[http://cmase.uark.edu/teacher/workshops/AIMS-lessons/Agent\\_Erosion.pdf](http://cmase.uark.edu/teacher/workshops/AIMS-lessons/Agent_Erosion.pdf)

A map of the United States which classifies landforms of the continental U.S..

[https://www.teachervision.com/tv/printables/concepts/es\\_transparencies\\_6.pdf](https://www.teachervision.com/tv/printables/concepts/es_transparencies_6.pdf)

Earthquake Facts for Kids

<http://earthquake.usgs.gov/learn/kids/>

Beyond Penguins and Polar Bears: Hands-On Science and Literacy Activities about Erosion, Volcanoes, and Earthquakes

<http://tinyurl.com/k38shq4>

[Climate Kids: NASA's Eyes on the Earth](#) Lessons and activities on weather and climate

[Climate Classroom Kids](#)