Dear Parents,

Our class is beginning a new science unit using the **FOSS Earth Materials Module**. We will investigate a selection of the most common rocks and minerals that make up Earth’s crust, and learn some techniques used by geologists to identify them.

Geology requires analysis. To develop analytical skills and techniques, we will first take apart a simulated rock called a Mock Rock. We will observe them, break them apart, dissolve them in water, and evaporate the liquid to discover the ingredients from which our rocks are made. We will then move on to real **rocks** and **minerals**, using scratch tools and acid (vinegar) to test for specific minerals. Finally we will look at granite, the base rock from which continents are made, and analyze it to discover the minerals it contains.

You can increase your child’s understanding and interest in earth materials by asking him or her to talk about the investigations we are doing at school. Rocks, which appear so commonplace, may become objects that inspire questions and promote close observation. You and your child may want to start a rock collection, or visit the library or (if possible) a rock and mineral display to expand your rock and mineral knowledge. A visit to a landscape materials center or a jewelry store (gems are minerals) can expose the broad range of uses for earth materials.

Watch for Home/School Connections sheets that I will be sending home from time to time. These activities describe ways the whole family can look more closely at rocks and minerals around your home. Your child will be asked to bring a rock or mineral to class for a few weeks to begin a class collection. He or she may choose to bring a special sample you picked up on a family outing, or a rock collected right around the neighborhood.

We’re looking forward to weeks of fun with rocks and minerals! If you have questions or comments, or have expertise you would like to share with the class, please drop me a note.
MATERIALS ASSEMBLY PROCEDURES

MOCK ROCK RECIPE

IMPORTANT:
Make mock rocks 1 WEEK BEFORE starting the activity. Allow them to air dry to become hard. Make one mock rock for each pair of students. Alum, sand, gravel, and oyster shells are in the kit.

INGREDIENTS

- 250 ml (1 cup) white flour
- 125 ml (1/2 cup) salt
- 10 ml (2 tsp.) alum
- 125 ml (1/2 cup) water
- 5 drops red food coloring
- 5 drops blue food coloring
- 3 drops yellow food coloring
- 250 ml (1 cup) coarse sand
- 125 ml (1/2 cup) gravel, 2 colors
- 30 ml (1/8 cup) oyster-shell pieces

EQUIPMENT

- Bowl or large zip bag
- Stirring spoon
- Measuring utensils
- Tray, cookie sheet, or plates
- Paper towels

(Makes 18 5-cm rocks)

MAKE THE MOCK ROCKS

1. Mix the flour, salt, and alum in the bowl or large zip bag.
2. Add the food coloring to the 1/2 cup of water.
3. Add the colored water to the flour mixture. Knead the mixture until it is uniform in color and texture and no longer sticks to the side of the bag or bowl. (Add a little more water if the dough is crumbly.)
4. Add the sand and the gravel to the mixture and knead until it is well mixed.
5. Divide the mixture into 18 balls, varying in size. Hold a rock ball in the palm of your hand, and with your thumb make a small hole in the center. Place 10–12 pieces of oyster shell in the hole and mold the dough around them.
6. Work the ball of dough in your hands, smoothing its surface. Flatten the rock so that it is 1–2 cm thick. (Thinner rocks dry more quickly.) Create a set of rocks that vary in size and shape by making each rock a little different.
7. Put the rocks on a plate or tray. Make sure the rocks do not touch each other. Place them in a warm area to dry. Turn them each day so they will dry thoroughly. It takes them about a week to dry, depending on the humidity.

NOTE: Do not put rocks in a microwave or electric oven; they get much too hard. Drying time can be reduced by placing the rocks in a traditional gas oven. Don’t turn on the oven. The heat from the pilot light will dry the rocks in 24 hours.

8. Use a paper towel to wipe the sand and gravel pieces from the utensils so that the solid materials do not go down the drain.

TEST THE MOCK ROCKS

Break one of the rocks after 6 days to make sure they are thoroughly dry and hard, but not so hard that they can’t be broken in half by hand and taken apart with the nail (the geologist’s pick).
Name _____________________________________________

Investigation 1: Mock Rocks

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Can be duplicated for classroom or workshop use.
Mock Rocks

Draw or trace your mock rock.

Observations

Calcite

Color ____________________________________________

Hardness: Put a check (✓) after the tools that can scratch calcite.

- fingernail _____________
- penny ________
- paper clip __________

Other observations

Granite

Which minerals do you think are in granite?

What's your evidence?

Magnified view of your rock
1. Diameter __________________________ Tool used ___________________________

2. __________________________ Tool used ___________________________

3. __________________________ Tool used ___________________________

4. Other measurements __________________________ Tool used ___________________________

Other observations

Hardness: Put a check (√) after the tools that can scratch the rock:

- Fingernail
- Penny
- Paper clip

Color __________________________

Mock Rock Measurements Dimensions

MICA

HORNBLende

TAKE IT FOR GRANITE

DATE
**MOCK ROCKS**

Observations about taking rocks apart with a “pick”

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

I have evidence to show the mock rocks contain these “minerals.”

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

**TAKE IT FOR GRANITE**

**FELDSPAR**

Color ________________________________

Hardness: Put a check (✓) after the tools that can scratch feldspar.

fingernail _________ penny _________ paper clip _________

Other observations

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

**QUARTZ**

Color ________________________________

Hardness: Put a check (✓) after the tools that can scratch quartz.

fingernail _________ penny _________ paper clip _________

Other observations

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________
Investigation 1: Mock Rocks

Rocks in Water

Observations after shaking

Observations after settling

Date: ___________

Put a check (✓) in the box next to the rocks that you are sure contain calcite.

Sandstone
Marble
Limestone
Basalt

Calcite
Vinegar

Evaporation Results

Date: ___________

Mock Rocks

Calcite QUEST

Page 5

Page 12
**MOCK ROCKS**

**EVAPORATING DISH**

Draw what you see in your evaporating dish.

![Evaporating Dish Diagram]

Explain what you see and how it got there.

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

**CALCITE QUEST**

**VINEGAR TEST**

What did you observe when you put each rock in vinegar? Write your observations below.

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<thead>
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<tbody>
<tr>
<td>Calcite</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Basalt</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Limestone</td>
<td></td>
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<td></td>
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<tr>
<td>Marble</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sandstone</td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

Put a check (√) by the rocks that you think contain calcite.
How is a mock rock like a real rock?

<table>
<thead>
<tr>
<th>Mock Rock Mineral Ingredients</th>
</tr>
</thead>
<tbody>
<tr>
<td>SANDSTONE</td>
</tr>
<tr>
<td>MARBLE</td>
</tr>
<tr>
<td>LIMESTONE</td>
</tr>
<tr>
<td>BASALT</td>
</tr>
</tbody>
</table>

Mock Rock Recipe

Date

Calcite Quest

Date
List the minerals in order of hardness.

<table>
<thead>
<tr>
<th>MINERAL 1</th>
<th>MINERAL 2</th>
<th>MINERAL 3</th>
<th>MINERAL 4</th>
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</table>

(Hardest)

List the minerals in order of hardness.

1. 
2. 
3. 
4.

How many tools could scratch this mineral?

<table>
<thead>
<tr>
<th>TOOL</th>
<th>Paper clip</th>
<th>Penny</th>
<th>Fingernail</th>
</tr>
</thead>
<tbody>
<tr>
<td>MINERAL</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
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<td>4</td>
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</table>

Investigation 1: Mock Rocks
No. 10—Student Sheet
A student wrote in her journal, “A rock is like a chocolate chip cookie.” What do you think she meant when she wrote that sentence?
CRYSTAL IDENTIFICATION KEY

EPSOM SALT

SODIUM THIOSULFATE

KOSHER SALT

SEA SALT

CITRIC ACID

ALUM
SCRATCH TEST

MINERAL IDENTIFICATION SHEET

#1

#2

#3

#4
Look at the pictures of the minerals below.

**TASK 1**
Use the letters by the minerals to show which minerals could be placed in each group.

- **DARK-COLORED**
- **LIGHT-COLORED**

**TASK 2**
Use the letters by the minerals to show which minerals could be placed in each group.

- **SHARP-EDGED**
- **SMOOTH-EDGED**

**TASK 3**
Use the letters by the minerals to show which minerals could be placed in each group. Think carefully where you would put minerals that have more than one property.

**TASK 4**
On the back of this sheet, explain how you decided where to put the letters for task 3.
Vera found one gray mineral and one white mineral. She wanted to test them for hardness, but she didn’t have any tools with her. Her fingernail could not scratch either mineral. So she rubbed one mineral against the other. When she looked at the minerals she noticed that the gray one had a scratch mark on it.

“Oh,” said Vera. “The gray one has a scratch, so the white one must be harder!”

Do you think Vera is correct? Explain your thinking.
CALCITE QUEST
ROCK IDENTIFICATION SHEET

BASALT

LIMESTONE

MARBLE

SANDSTONE
A fourth-grade boy tried the calcite test at home. He found two different rocks in his backyard and put them into small glasses of vinegar that he labeled A and B. He noticed that there were bubbles in both glasses. In A there were only a few bubbles and they stayed on the rock. One of them floated to the top of the vinegar. In B there were many bubbles coming from all over the surface of the rock. The next day he poured some of the vinegar from each vial into a shallow dish and let the liquid evaporate. What do you think he found in the two dishes after all the liquid evaporated? Why do you think so?
## Rock and Mineral Identification Sheet

### Take It for Granite

<table>
<thead>
<tr>
<th>Granite</th>
<th>Calcite</th>
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<table>
<thead>
<tr>
<th>Hornblende</th>
<th>Mica</th>
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<tr>
<td><img src="Image" alt="Blank" /></td>
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<table>
<thead>
<tr>
<th>Feldspar</th>
<th>Quartz</th>
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<tbody>
<tr>
<td><img src="Image" alt="Blank" /></td>
<td><img src="Image" alt="Blank" /></td>
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</table>
FOSS EARTH MATERIALS MODULE

PROJECT IDEAS

- Make a batch of cookie rocks to share with the class. Be sure to list the “minerals” you used to make the cookie rocks.
- Bring in your own rock and mineral collection. In your presentation be ready to tell the class about each sample.
- Write a letter to the U.S. Geological Survey. See the teacher for the address and what to order.
- Interview a geologist. Write a list of questions, then interview a geologist in person or over the phone. Tell what you learn to the class.
- Seriate a set of rocks or minerals by a property such as weight, diameter, circumference, or other property. Explain your methods to the class.
- Research the Mohs’ scale. Make a poster to show a mineral for each hardness, 1 through 10.
- Find some other rocks that you can test for calcite. Show what rocks you used, how you tested them, and what your results were.
- Use warm vinegar to see if you get different results in the fizz test.
- Check with the U.S. Department of Agriculture or a garden supply company to find out how limestone and its products are used in farming.
- Research the uses of Portland cement. What is it and how is it used?
- What is your state rock or mineral? Why was that one selected?
- Each county has a Natural Resources Conservation Service unit, part of the U.S. Department of Agriculture. Find out what information on local rocks and minerals is available from the NRCS.
- Take a survey around the neighborhood about how different earth materials are used for construction of buildings, sidewalks, roads, decoration, and so forth.
- Library Research. Find the answer to one of the questions below and present information to the class.
  - How do caves form?
  - How many forms of calcite are there?
  - How do rocks such as limestone and marble form?
  - What is a sinkhole? How does one form?
  - Where do geologists look for petroleum?
  - How are some of the rocks and minerals we studied used?
  - What is spelunking? Would you like to try doing it?
  - What is a fossil? What kinds of rocks are fossils found in?
  - Where is most of the basalt or granite on Earth?
- Look in the Science Stories or books in the library for ideas about projects you might like to present to the class.
- What kind of rocks and minerals were found on the moon?
FOSS EARTH MATERIALS MODULE

PROJECT PROPOSAL

1. What is the question or the project that you are proposing?

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

2. What materials or references will you need to complete the project?

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
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3. What steps do you need to take to complete the project?

________________________________________________________________________
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PRESENTATION GUIDELINES

You will have exactly 3 minutes to present your project to the class. In those 3 minutes you should answer these questions.

- What were you trying to find out (your question)?
- What materials or references did you need to do your project?
- What procedure did you follow to complete your project?
- What did you learn from doing your project?

When you begin speaking you will see the green card held up. When you see the yellow card, you have 30 seconds left. When you see the red card, it means you can finish your sentence, but you must stop within the next few seconds.

Practice your presentation so you will be sure it is at least 2 1/2 minutes long, but not more than 3 minutes long. Be sure you have included all of the information asked for above.
MATH EXTENSION—PROBLEM OF THE WEEK

INVESTIGATION 1: MOCK ROCKS

On his vacation Jay hunted for special rocks for his collection. On the first day he found two rocks. The next day he found four rocks. On each day of his vacation Jay found two more rocks than he had found the day before. On what day did Jay have 42 rocks in his collection?
MATH EXTENSION—PROBLEM OF THE WEEK

INVESTIGATION 2: SCRATCH TEST

Cheryl and Vincent were testing minerals for their hardness. After working all day they had tested 57 minerals. Cheryl tested nine more minerals than Vincent. How many minerals did each student test?
INVESTIGATION 3: CALcite QUEST

Josiah and Parisa were playing a game. They had agreed that, at the end of each round, the loser would give the winner a rock from his or her collection. After playing the game for a while, Josiah had won three games. Parisa had three more rocks than she did when they began. What is the fewest number of rounds they could have played?
MATH EXTENSION—PROBLEM OF THE WEEK

INVESTIGATION 4 TAKE IT FOR GRANITE

Anders, Catherine, Dustin, Yelda, Rocky, and Maren are rock collectors. Each collector has chosen some rocks from his or her collection to trade. Each collector is going to trade with every other collector. How many different pairs of collectors will trade with each other?
# ROCK PICTURE CARDS FOR ROCK LINEUP

*(CUT AND COLOR ONE SET FOR EACH GROUP)*

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<td><img src="image18" alt="Rock 18" /></td>
<td><img src="image19" alt="Rock 19" /></td>
<td><img src="image20" alt="Rock 20" /></td>
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</tbody>
</table>

COLOR THIS COLUMN OF ROCKS RED.
ROCK LINEUP #1

(TCUT CARDS APART)

ROCK LINEUP #1

TWO ROCKS ARE RED.
TWO ROCKS ARE WHITE.
ONE ROCK IS BLACK.

ROCK LINEUP #1

A RED ROCK IS IN THE FRONT OF THE LINE.
TWO WHITE ROCKS ARE AT THE BACK OF THE LINE.

ROCK LINEUP #1

THERE ARE FIVE ROCKS IN LINE.

ROCK LINEUP #1

A RED ROCK IS IN THE MIDDLE OF THE LINE.

NOTE: EACH GROUP NEEDS FIVE ROCKS OF EACH COLOR: RED, WHITE, GRAY, AND BLACK.
ROCK LINEUP #2

(ATTACH CARDS APART)

ROCK LINEUP #2

ROCK LINEUP #2

ROCK LINEUP #2

TWO RED ROCKS ARE JUST IN FRONT OF TWO GRAY ROCKS.

ROCK LINEUP #2

TWO BLACK ROCKS ARE JUST BEHIND TWO GRAY ROCKS.

THERE ARE TWO RED ROCKS, TWO WHITE ROCKS, TWO GRAY ROCKS, AND TWO BLACK ROCKS IN LINE.

ROCK LINEUP #2

ONE WHITE ROCK IS FIRST IN LINE. ONE WHITE ROCK IS LAST IN LINE.

NOTE: EACH GROUP NEEDS FIVE ROCKS OF EACH COLOR: RED, WHITE, GRAY, AND BLACK.
ROCK LINEUP #3

There are two lines of rocks. There are five rocks in each line.

NOTE: Each group needs five rocks of each color: red, white, gray, and black.

(CUT CARDS APART)
ROCK LINEUP #4

(CUT CARDS APART)

ROCK LINEUP #4

THREE GRAY ROCKS ARE AT THE FRONT OF ONE LINE.

ROCK LINEUP #4

THERE ARE TWO LINES OF ROCKS. THERE ARE SEVEN ROCKS IN EACH LINE.

ROCK LINEUP #4

FOUR RED ROCKS ARE AT THE BACK OF ONE LINE.

ROCK LINEUP #4

IN ONE LINE, THERE ARE THREE BLACK ROCKS AND FOUR WHITE ROCKS. EACH BLACK ROCK IS JUST BEHIND A WHITE ROCK.

NOTE: EACH GROUP NEEDS FIVE ROCKS OF EACH COLOR: RED, WHITE, GRAY, AND BLACK.
ROCK LINEUP #5

(THE REGENTS OF THE UNIVERSITY OF CALIFORNIA)

There are four groups of rocks. There are four rocks in each group.

Put the rocks in groups!

There are four red rocks, four gray rocks, four white rocks, and four black rocks.

Put the rocks in groups!

One group has two gray rocks. One group has two red rocks.

Put the rocks in groups!

Each group has exactly one white rock.

Put the rocks in groups!

One group has only black and white rocks.

Put the rocks in groups!

One group has a rock of each color.

Put the rocks in groups!

Note: Each group needs five rocks of each color: red, white, gray, and black.

ROCK LINEUP #5
ROCK LINEUP #6

(TCUT CARDS APART)

THERE ARE FIVE GROUPS OF ROCKS. EACH GROUP HAS THREE ROCKS.

PUT THE ROCKS IN GROUPS!

THERE ARE FIVE RED ROCKS, FOUR GRAY ROCKS, THREE WHITE ROCKS, AND THREE BLACK ROCKS.

PUT THE ROCKS IN GROUPS!

IN ONE GROUP ALL THE ROCKS ARE RED.

PUT THE ROCKS IN GROUPS!

TWO GROUPS LOOK THE SAME.

PUT THE ROCKS IN GROUPS!

BLACK ROCKS ARE FOUND IN THREE GROUPS.

PUT THE ROCKS IN GROUPS!

EVERY GROUP WITH A BLACK ROCK ALSO HAS A WHITE ROCK.

PUT THE ROCKS IN GROUPS!

NOTE: EACH GROUP NEEDS FIVE ROCKS OF EACH COLOR: RED, WHITE, GRAY, AND BLACK.
HOME/SCHOOL CONNECTION

INVESTIGATION 1: MOCK ROCKS

BRING A ROCK TO CLASS

Plan to bring one or two rocks to school to share with the class. Choose samples from rocks you have at home, or go outside and find some interesting rocks in your neighborhood.

Put three or four rocks on a table and give each person in your family a piece of paper and a pencil. Have everyone choose one of the rocks to write about, but don’t let anyone say which rock they have chosen. Have everyone write a riddle that describes one of the rocks on the table. Take turns reading the riddles out loud. Can everyone else determine which rock the riddle was about? If they guess wrong, ask them what would have helped them to guess correctly.

Write your favorite riddle below. Bring the rock and the riddle to school to share with the class. (Don’t show any of your classmates, though, until your teacher tells you to!)

ROCK RIDDLE

________________________________________

________________________________________

________________________________________

________________________________________
HOME/SCHOOL CONNECTION

INVESTIGATION 2: SCRATCH TEST

BIRTHSTONES

Tell your family what you learned about birthstones from the FOSS Science Stories book. Tell them about the difference between rocks and minerals.

Ask family and friends when their birthday is and see if they know their birthstone. (If they don’t, you can tell them!) Then complete the chart below and make a bar graph to show which month among your family and friends has the most birthdays.

<table>
<thead>
<tr>
<th>January</th>
<th>Garnet</th>
<th>Name of person</th>
<th>Birthday month</th>
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</thead>
<tbody>
<tr>
<td>February</td>
<td>Amethyst</td>
<td>1.</td>
<td></td>
</tr>
<tr>
<td>March</td>
<td>Aquamarine</td>
<td>2.</td>
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<tr>
<td>April</td>
<td>Diamond</td>
<td>3.</td>
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<td>May</td>
<td>Emerald</td>
<td>4.</td>
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<tr>
<td>June</td>
<td>Alexandrite</td>
<td>5.</td>
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<td>July</td>
<td>Ruby</td>
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<td>August</td>
<td>Peridot</td>
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<td>September</td>
<td>Sapphire</td>
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<td>October</td>
<td>Opal</td>
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<td>November</td>
<td>Topaz</td>
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<tr>
<td>December</td>
<td>Turquoise</td>
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</table>
**INVESTIGATION 3: CALCITE QUEST**

**CALCITE TEST**

Explain to members of your family how geologists test rocks to see if they contain the mineral calcite as one of their ingredients.

If you have some vinegar at home, see if you can find five or six rocks to test for calcite. Take a short walk with your family around the neighborhood to find rocks to test.

Keep a record of your findings in the space provided below.

It is advisable not to use special rocks, such as fancy crystals or valuable rocks. The vinegar could change their appearance and lessen their value.

<table>
<thead>
<tr>
<th>ROCK PROPERTIES</th>
<th>TEST RESULTS</th>
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HOME/SCHOOL CONNECTION

INVESTIGATION 4: TAKE IT FOR GRANITE

EARTH MATERIALS HUNT

Use the clues to find items around your house that are made of earth materials.

1. See if you can find something made from bauxite. Bauxite (aluminum) can be refined into a very thin metal good for packaging liquids.

2. See if you can find something beautiful that someone might wear, made from an earth material.

3. Sometimes people use earth materials to make lamps and other decorative items for the home. Can you find something?

4. Look at the thermometer you use to find out if you have a fever when you’re sick. Which part of the thermometer do you think is made from earth materials?

5. Look outside. Can you find something that you walk on everyday that is made from earth materials?

6. Can you think of a place that you have visited that had some interesting rocks or minerals? What is the name of the place? What was so interesting?

7. There is an earth material that most people eat all the time. Imagine that! Its mineral name is halite. It’s shaped like little white cubes, and you use it a lot in cooking.