Lesson 2: Rock Stories

Overview

Wish you could take more field trips? You can! Your own schoolyard is filled with great geologic features! In this lesson, students learn that a rock's properties tell stories about where it came from and where it has been. The lesson illustrates how to make geologic observations and gives background about the important properties of rocks to observe. Students then use those observation skills to describe rocks they find on their own Schoolyard. This web site describes specific "geologic" features found on playgrounds (with photos and rocks from example schools).

Learning Outcomes

- Not all rocks look the same, and the things that make rocks look a little different from one another give clues about each rock's "story."
- Sedimentary rocks are made up of pieces of smaller rocks. For this exercise, we'll call them "grains," but they are often called "clasts."
- Sedimentary rocks go through the following stages on the way to becoming a rock: Weathering, Erosion, Transport, Deposition, and Cementation.
- Mechanical weathering is the process of breaking rocks into smaller pieces and then smoothing those pieces out.
- Rusting metal is an example of chemical weathering.
- GRAIN SIZE tells us about how much energy it took to move the grains. Transport of big grains (boulder sized) requires a lot of energy and can only happen in rapidly flowing rivers during floods, or massive landslides. Smaller grains can be transported in gently flowing streams, across lakes, and far out into the ocean.
- GRAIN SHAPE tells us about the mechanical weathering history. In the process of being transported, mechanical weathering continues as rocks get smoothed and rounded over time. The longer a rock spends in a weathering environment, the rounder it gets.

Materials

Photocopies.
A schoolyard or area surrounding your school where you have permission to take your class during school hours.

Prepared graphics in a presentation, complete with commentary, are available for you to download as a Powerpoint or PDF file. Computer projector or overhead projector with color printer required. (optional)

Since students may need to sit on the ground during some outdoor exercises, it can be good to warn them a day ahead to wear clothes that can get dirty. This can heighten the anticipation, as well.

Time Requirements

2-3 class periods
Preparation: A few minutes of walking around your schoolyard looking for good examples of geologic building materials or natural rock outcrops and filling in a "mystery rock" description.

Downloads

Download the instructions as a single PDF File
Download PowerPoint file with all the images

Background

Class Period 0

- Your students should begin with an understanding of sedimentary rocks and their role in the rock cycle. We recommend that you review the following web page about sedimentary rocks, which could also be printed and assigned as student reading:

  <**Sedimentary Rocks**>

  We also recommend several activities from the Illinois State Museum. For introducing the rock cycle, we recommend: Ride the Rock Cycle a kinesthetic learning game (usable for a wide range of ages).

  Shortly after students have been introduced to different types of rocks, you can begin the activity below.

Introducing the Activity

(Note: You can download a prepared presentation with this activity here)

Begin by asking students, "Close your eyes and picture 'a rock.' Did you picture a boring, grey stone?"

Pass around a few sample rocks to your class. Or, alternatively, show these photographs on an overhead. Tell students that these are examples of a few rocks. Either in pairs or by raising their hands, ask the students to describe features of the rocks. Write some of their responses on the board.

Tell students, "Not all rocks look the same, and the things that make rocks look a little different from one another give clues about each rock's 'story.' By making careful observations of a rock, geologists can tell where a rock came from and what has happened to it. Since every rock has a slightly different story, it's important to notice the differences in the rocks."

Click on an image to enlarge it.

Using their own observations on the board, you can transition into a general discussion of important rock properties (see Class Period 1).

Class Period 1

- In the opening activity, your students introduced some of the important properties to distinguish rocks. Begin this activity by reminding students about that idea, and add add, "Since some rocks, called sedimentary rocks, are made up of pieces of bigger rocks that are combined, we can learn a lot about a rock by looking at the individual pieces that make it up."

  Show a picture of a sedimentary rock. The tiny pieces that make up this rock are called 'grains.' These grains are one of the biggest clues about a rock's history, so we'll spend today learning to describe the grains. It is is important to note that when grains are cemented together into one big piece, we call that whole piece a rock. So when you walk outside onto your playground, geologists would refer to the entire surface as a single rock made up of smaller pieces called grains. Also see Misconceptions section below.

Use the photographs and description on the following web page to introduce the definition of grains, COLOR, GRAIN SIZE, and GRAIN SHAPE.

<**Rock Stories: Describing Sedimentary Rocks**>

Instructions

- Pass out photocopies of the Rock Description Table and Student Instructions. Students will need several pages of the blank tables.
- Using an image of a rock on the overhead projector, fill in the table as a class. For example, start with this photo of a schoolyard conglomerate. As you introduce each property, refer to the instruction page about the type of information they are expected to fill in.
- Discuss with students the interpretation of these properties. Use the information in Describing Rocks and Example Descriptions to determine the history of this particular rock sample. Show an image of the environment (e.g., gentle stream, landslide, etc...)
- Show an image of another rock. Ask students to silently fill out a second copy of the table for this rock. They can raise their hands with individual questions.
- Now ask the students if they can interpret their observations. What was this rock's story?

Class Period 2: Geologic Excursion to the Schoolyard

- Start the class by reviewing the rock properties from the previous lesson.
- The class is now ready to apply their knowledge "in the field." They will need a pen, a few blank copies of the Rock Description Table and Student Instructions, a ruler, and something firm to write on in the field (a book or binder). Begin by taking the class outside.
- Walk around the schoolyard and have students point out where they see rocks. Walk them past any geologic building materials (brick, concrete, asphalt, sandbox, etc...) or natural rock outcrops (if you are lucky enough to have one at your school site) that you know.
- Have each student or pair of students pick a small area of the "rock" that they will describe. It's often best to have students sit down on the ground while doing their description ("Real geologists aren't afraid to get dirty."). Have students fill in the blank table with a description of their rocks. After a few minutes, have students move to another location.
- Hand out photocopies of a "mystery rock description" (a Rock Description Table that you filled out for a certain exposure of rock). Have the students go hunting for this particular rock exposure.

Closing the Activity

Give students a few blank copies of the Rock Description Table and have them fill it out for geologic materials at home or on their way home. Be sure to instruct them that they are NOT allowed to describe any roads (for safety).

Homework

Have students draw a picture of the history of one rock that they described. If they think that their rock came from a raging river, have them draw a picture of it.

Common

Misconception: When completing the activity, many students go up to a rock whose grains are actually smaller pieces of rock and only recognize that the individual grains are rocks. They don't acknowledge that the whole thing is itself a rock made up of smaller rocks.
Fact: In geology, we call a rock made up of other pieces of rock a sedimentary rock. If those pieces are made up of individual grains of sand, we call the bigger rock a

Common Misconceptions

sandstone. If those pieces are bigger, like pebbles or boulders, we call a huge rock with all the pieces together a "conglomerate." Many schoolyard rocks are conglomerates. Teachers should be sure to point out that the whole of a playground might be a single conglomerate rock because it is made up of pieces of smaller rocks cemented together into one piece. Ask students, "how big are the individual grains of the rock you found? How big is the whole rock, with all the grains put together?"

Assessment

Science Standards

California

Gr1, Sc4b. Record observations and data with pictures, numbers, or written statements.

Gr1, Sc4e. Make new observations when discrepancies exist between two descriptions of the same object or phenomenon.

Gr2, Sc3. Earth is made of materials that have distinct properties and provide resources for human activities. As a basis for understanding this concept:

Gr2, Sc3a. Students know how to compare the physical properties of different kinds of rocks and know that rock is composed of different combinations of mineral

Gr4, Sc4a. Students know how to differentiate among igneous, sedimentary, and metamorphic rocks by referring to their properties and methods of formation (rock cycle).

Gr4, Sc5a. Students know some changes in the earth are due to slow processes, such as erosion, and some changes are due to rapid processes, such as landslides, volcanic eruptions, and earthquakes.

Gr4, Sc5b. Students know natural processes, including freezing and thawing and the growth of roots, cause rocks to break down into smaller pieces.

Gr4, Sc5c. Students know moving water erodes landforms, reshaping the land by taking it away from some places and depositing it as pebbles, sand, silt and mud in other places (weathering, transport, and deposition).

Gr6, Sc2. Topography is reshaped by the weathering of rock and soil and by the transportation and deposition of sediment.

Gr6, Sc2a. Students know water running downhill is the dominant process in shaping the landscape, including California 's landscape.

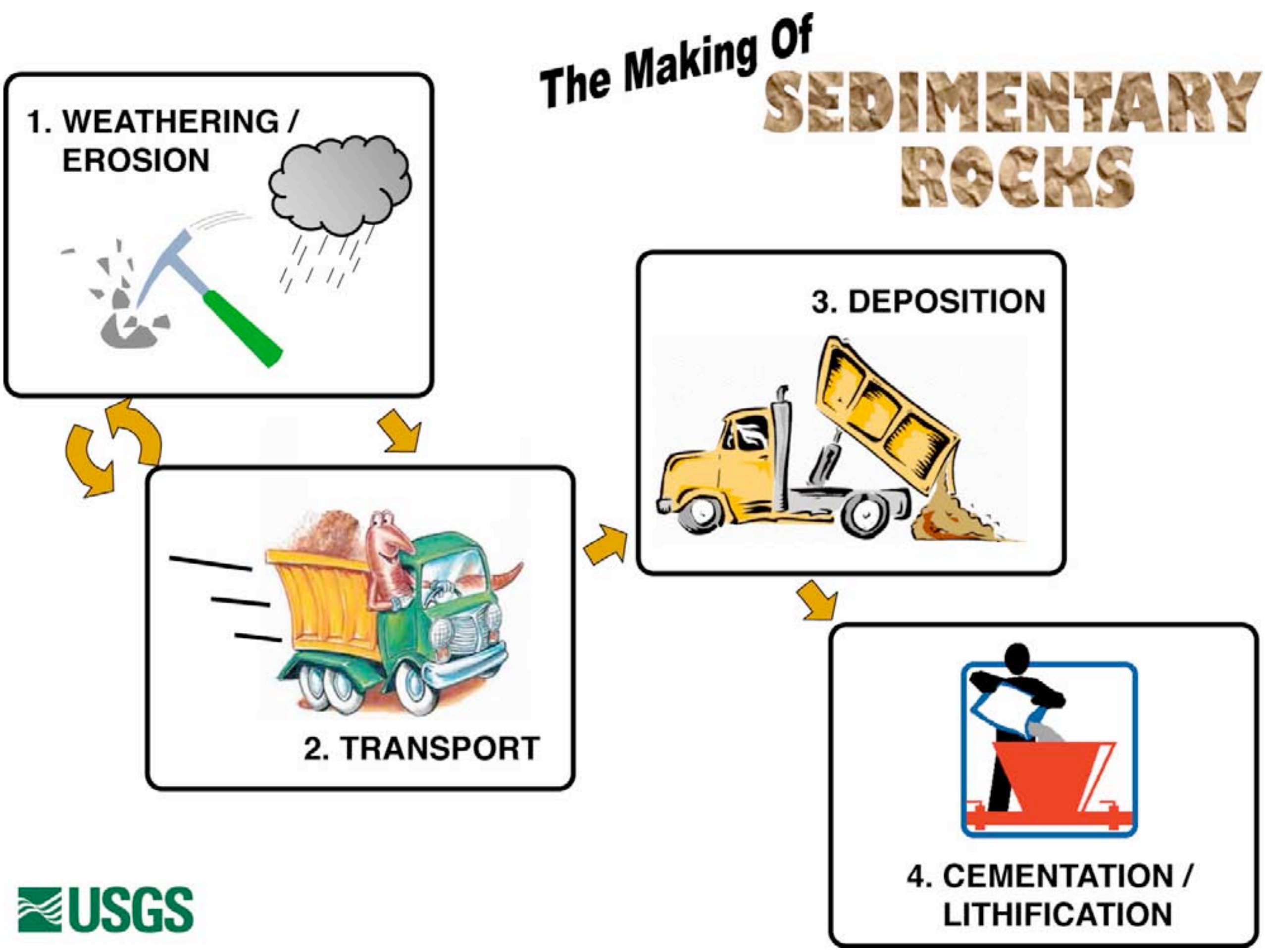
Gr6, Sc2b. Students know rivers and streams are dynamic systems that erode, transport sediment, change course, and flood their banks in natural and recurring patterns.

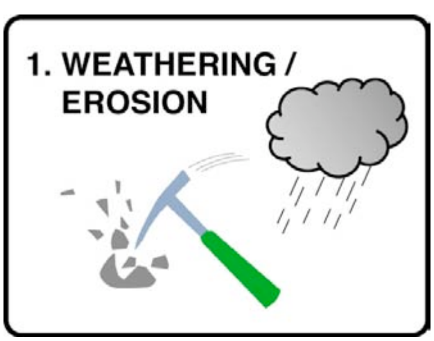
Gr6, Sc2c. Students know beaches are dynamic systems in which the sand is supplied by rivers and moved along the coast by the action of waves.

Gr7, Sc4c. Students know that the rock cycle includes the formation of new sediment and rocks and that rocks are often found in layers, with the oldest generally on the bottom.

Gr7, Sc7c. Communicate the logical connection among hypotheses, science concepts, tests conducted, data collected, and conclusions drawn from the scientific evidence.

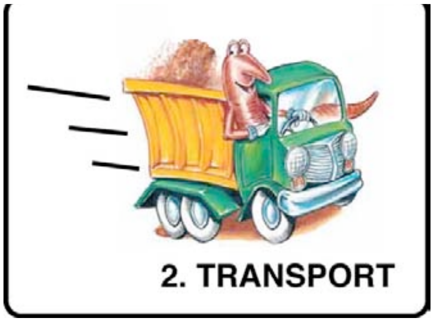
Gr9-12, ES3c. Students know how to explain the properties of rocks based on the physical and chemical conditions in which they formed, including plate tectonic processes.



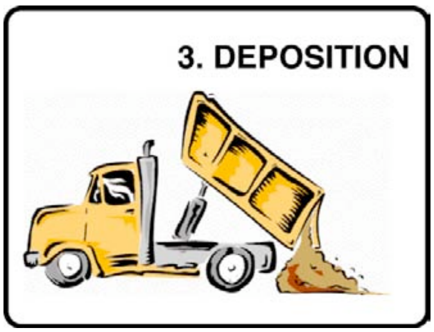


Breaking rocks up into smaller pieces. There are lots of processes that cause rocks to break apart into smaller pieces. No matter what causes the rock to break, we call the smaller pieces "sediment." A rock that forms from these smaller pieces of sediment is called a "sedimentary rock!" Keep in mind that even though sediments are 'smaller' pieces of rock, they might be still be the size of a house if they broke off a the side of a massive mountain. Regardless of whether they the size of a pea or the size of a car, we call all pieces of rock that break off from other rocks "sediment."

Moving those pieces.... Water, wind, and gravity are the main things that move pieces of rock from place to place.



Sediment may get transported thousands of miles by one of the world's major rivers, or it may just go from the top of the hill to the bottom during a landslide. During this journey, a lot can happen to the sediment. For example, it can continue to erode into smaller pieces during transport. This happens because a piece of rock may bump into other rocks during transport and break into smaller pieces (erosion!). So transport can also include some erosion, and the longer it takes to transport a rock, the more chance it has to erode even more.



...until you stop moving the pieces. Once the sediment stops being transported, you have a bunch of pieces of sediment in one place. A pile of sand is an example, and you might find such a pile at a sandbar along the edge of a river. You can also find sediment that has been deposited at the bottom of steep hills, at the beach, in sand dunes, and many other places on earth. Bigger size pieces are harder to transport, so they tend to stop moving (deposition) before smaller pieces. For example, a huge boulder cannot move in a tiny trickle of water, but may move during a raging flood. Similarly, a muddy river flowing into the ocean may dump most of the larger pieces of sediment near the coast in what we call a "delta," but the really tiny pieces stay suspended in the water and can travel far out into the open ocean before finally settling to the bottom.
You can try this in the classroom -- throw a scoop of sand and soil into a glass bottle. The largest grains of sand will fall out quickly, but the water at the top will remain muddy for hours. If you leave the bottle long enough, even the fine grains will settle and leave clear, clean water at the top of the bottle.

Turn the individual small pieces back into a solid rock by cementing them together. So far, we've broken a rock into tiny pieces and moved the pieces from one place to another so that we have a pile of loose sediments -- not a hard rock. The evolution of sediment into rock typically takes thousands of years or longer in nature. Most sedimentary rocks are held together by the minerals calcite and quartz that act like cement to hold the individual pieces of sediment together. The combination of higher temperatures and pressures speeds the process of cementation. If sediment continues to be deposited in the same place, newer layers of sediment will bury older sediment. The added weight of the newer sediment increases the pressure on the older sediment and squeezes the bottom layers. The layer of newer sediment also acts like a blanket insulating the lower layers such that the temperature also increases. So as sediments get buried by other sediments, they can eventually become "as hard as a rock!"

The fact that burial is so important in the last stage of making sedimentary rocks also helps explain why **sedimentary rocks tend to form in layers**. Layers most often reflect individual pulses of deposition -- like individual floods, wet seasons, or even climatic periods lasting millions of years. If a river, lake, or ocean stays around for many years so that it experiences lots of deposition events, there will be layer on top of layer on top of layer in the same spot. Because the newest layers always form on the top (burying older layers), geologists can read these layers like the pages of a history book.

When Rocks Tell Stories: Describing Rock Properties

Look at the three images of rocks shown below. What are the similarities? What are the differences?

Click on an image to enlarge it.

NOT ALL ROCKS LOOK THE SAME!

Close your eyes and picture "a rock." Did you picture a boring, grey stone? Not all rocks look the same, and the things that make rocks look a little different from one another give clues about each rock's "story." By making careful observations of a rock, geologists can tell where a rock came from and what has happened to it since that time. Since every rock has a slightly different story, it's important to notice the differences in the rocks. You can do it, too! Once you learn a little about the processes that shaped one rock, you can find other rocks that had similar experiences by looking for rocks that look similar.

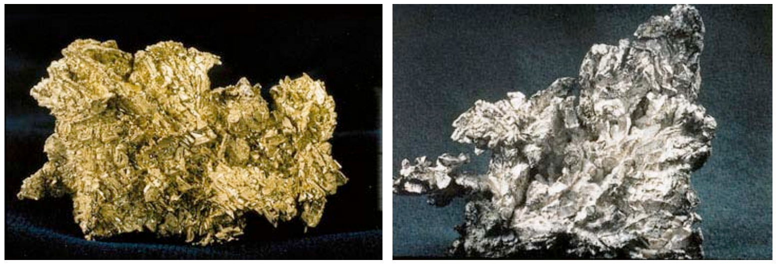
Individual pieces of a rock called *GRAINS*
Many rocks are made up of smaller pieces. Sometimes the grains of a rock are all the same and sometimes a rock is made up of all sorts of different grains.

The individual grains from different classes of rocks (i.e., igneous, metamorphic, and sedimentary) develop by different processes. For example, a sedimentary rock might have individual grains of sand held together by a natural cement. Grains of an igneous rock are individual crystals that have grown as a magma cooled. Observations of grains help tell a story about the entire rock, but the observations must be interpreted in different ways for these different rock classes.

This web page focuses on *Sedimentary rocks* because most rocks you find in your schoolyard are sedimentary rocks (often made by humans, such as cement, asphalt, etc.).

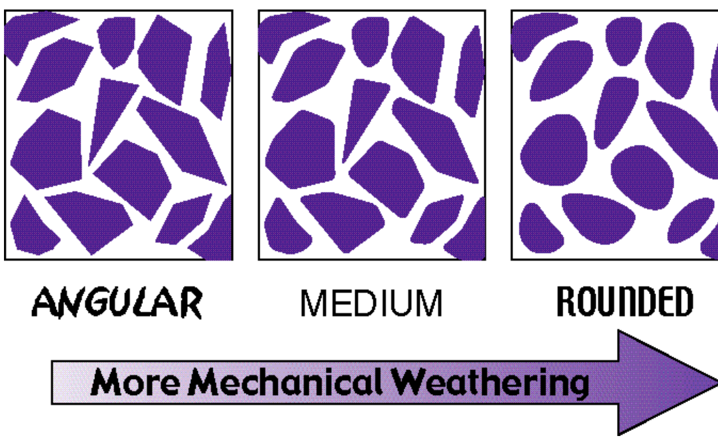
COLOR gives clues about composition
What is your rock made out of? You can't tell just by looking, but grains with different chemical compositions are often different colors. Knowing a rock's composition can tell you if the rock came from deep within the earth, formed at the bottom of the ocean, or was exposed to wind and rain. For

example, some grains are the same color as rusted metal (reddish-brown). The similarity in color is also related to similar history -- the rust-colored grains might be a mineral called "hematite," which is composed entirely of iron and oxygen. Just like rusted metal, iron in the grains rusts when exposed to oxygen in air and water. We call this process **chemical weathering**. Not all red grains are made from the same elements, but color does give clues about composition and is the easiest thing to notice.



Color is a clue about composition: Gold v. Silver
Images From: *USGS / US House of Representatives*
http://resourcescommittee.house.gov/subcommittees/emr/usgsweb/frames/main.html

GRAIN SHAPE tells us about the mechanical weathering history
People rub wood with sandpaper to smooth it, and the same thing happens to rocks. When rocks first break apart, they are split into sharp, angular pieces. So most grains start out angular. Over time, they get worn smooth by wind, water, and other rocks. We classify grains based on their "Roundness." Rounded grains have very few sharp edges and corners. The opposite of "Round" is "Angular." The process of breaking rocks apart and smoothing them down is called **mechanical weathering** and usually happens when rocks are moved (transported) by forces like wind, water, glaciers, or in a landslide. Rounded rocks have been exposed to more mechanical weathering; they have traveled further, they have been around for longer, or existed in areas with more rubbing and abrasion.



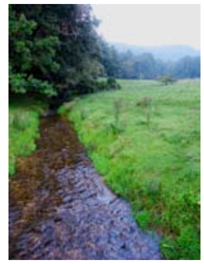
GRAIN SIZE tells us about how much energy it took to move the grains
Some grains are big and some are small. To move a giant boulder takes a lot more energy than to move a tiny sand particle. Which is more likely to move a giant boulder: a trickling stream or a raging river? So if you see a massive boulder in the middle of a dry creek bed, you know that there had to be a whole lot of water rushing through it at one point. In addition to the amount of water, gravity also gives streams energy to move boulders. Streams on steeper hills can be higher energy than streams on gentle slopes.

Big grains take a lot of energy to move.
Click to enlarge.

Images From: *USGS*.
http://pubs.usgs.gov/of/2001/ofr-01-0144/ (left)

Click to enlarge.
Image Copyright: *Oklahoma University*
http://www.earthscienceworld.org/imagebank/search/results.html?ImageID=hn86m8 (left)

A high energy river system is able to move bigger rocks. Look at the boulders in the white water of this stream. The largest rocks moved last when the river was moving even faster than it is in this photograph.



Click to enlarge.
Image Used by Permission from *Black Dove Stock Photography*.
http://www.deviantart.com/deviation/15053728/ (right)

This is a very low energy creek. The water moves more slowly and there is less of it, so there are no boulders here. Looking closely at the shadows beneath the water surface, you can see the shape of individual rocks that are all smaller than about 10 cm. That means that not only is it slow now, but that it has probably never had enough energy to move large boulders (otherwise, they would have been left behind in the creek).

SCHOOLYARD "Rocks"
The man-made materials like cement, concrete, asphalt, and brick that you find around your schoolyard are not that different from natural sedimentary rocks. They are all made from natural rocks: Cement comes from ground up rock called "limestone", concrete usually has sand or small pebbles in it, asphalt has crushed rock mixed with tar, and brick is made from baked mud. You can learn about where these natural rocks came from by looking at the rock-like materials in your schoolyard.

Above, we said rust-colored rocks are often the product of chemical weathering. Can you find any rust colored building materials in your schoolyard? How about bricks? Bricks are clay that has been baked at very high temperatures. The color of a brick is related to chemical weathering of iron and other elements that are commonly found in clays. The chemical weathering process happens much faster when the temperature is really hot (like 1500 degrees!), so brick manufacturers are able to cause weathering that might take thousands of years at the earth's surface in just a few hours in their hot brick kilns. The color of a brick depends on the original clay composition and the temperature to which it is heated.

You can sometimes even learn something about the history of your city from looking at schoolyard building materials. For example, some older concrete is made with very rounded grains. Because they are rounded, we know that they came from an environment that smoothed them out -- probably the bottom of river bed. However, a lot of newer cement has very angular grains. Why the change? It turns out that most cities and towns have grown so much over the years that they have used up all of the easily accessible river gravels nearby. It is often cheaper to dig huge chunks of rock out of the ground and crush them into smaller pieces than to transport the naturally small gravel from far away places. In other words, many of the angular grains we see in concrete today are the product of instant "mechanical weathering" caused by machines. The smoother, rounded grains from older concrete are the product of lots of mechanical weathering over thousands of years by nature.

A crushed rock quarry in San Rafael, California. Picture taken from a small airplane, and you can see nearby roads and a golf course in the background to get a sense of the size of the operation. The pit is about 200 feet deep.

Image From: *County of Marin*. Click to enlarge.

http://www.co.marin.ca.us/depts/GJ/main/cvgrjr/2000gj/ssrq/SRRQREPT.pdf

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Related Student Activity

Rock Stories	Lesson Instructions that draw on the background on this page.
Downloads: Lesson 2	Download a prepared presentation in Powerpoint or PDF format with the content of this lesson.
Rock Description Table with Preformatted Student Instructions	Now that you know about rock properties, you'll want to continue on to the student intsructions.

ACTIVITY

DESCRIBING WHAT YOU SEE

As a geologist, you need to practice describing rocks in detail. It's not enough just to say "it's a rock." You need to be very specific and mention each of the properties that make one rock different from another.

Find a particularly interesting rock on your schoolyard. It can be either natural or man-made. Describe the rock in detail. If you aren't familiar with rocks already, refer to this web page. Here is a table that you can use to help guide you to describing rocks clearly. You'll describe the following properties:

Location	• Where did you find this rock? You may not remember in a few days, so write it down so that you can come back. Also, other people will be able to come see the rock you described.
Color	• Describe the colors as clearly as you can in words. For example, "dark brown" is different than "light brown" or "reddish brown." • Are any of the grains shiny or do they sparkle? Mention that! • If there is more than one color, describe each color. Also, mention if one color is the most common color. You can even quantify this using percentages: "50% white grains, 30% pinkish-grey grains, 20% shiny brownish-black grains."
Grain Size	• It's not enough to just say that the grains are "big" or "small" because what you define as big might be small to someone else. As a scientist, you should measure the grains! Use a ruler to measure the grains. Don't worry, you don't need to measure them all! • Try to find one of the smallest grains (it shouldn't be *the* smallest in the entire rock, but one of the smallest) and measure its size. That is the minimum grain size. Then, measure one of the largest grains and record its length as the maximum grain size. • Sometimes grains are long and narrow. For those, write out "2 cm long by 0.5 cm wide." • If the grains are really tiny, you can write "grains too small to measure." • If the rock looks like one solid mass and you can't see individual grains, write, "grains too small to see." • Based on your measurements, are most of the grains about the same size?
Grain Shape	• Look at the grain shape. Are the grains sharp and angular? Or are they rounded? Or are they somewhere in between? Circle the words that best describe the rock you are looking at.
Strength	• Is the rock hard and solid, or is it a bit crumbly?

Other Comments	• This is space for you to right anything else interesting about the rock.

Location	
Colors	
.....All the same color?	
Grain Size	
.....Minimum grain size	____ cm
.....Maximum grain size	____ cm
.....All the same size?	
Grain shapes	Rounded ... Medium Rounded ... Medium Angular ... Angular
Strength	
Other Comments	

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Example Rock Descriptions

Here are some examples of "rocks" that we found on schoolyards and sidewalks near schools. For information about how to fill out the table, click here.

Location	outside Art Studio, UC Berkeley
Colors	Dark Grey.
.....All the same color?	Yes. Almost no difference between grains.
Grain Size	
.....Minimum grain size	0.3 cm
.....Maximum grain size	2 cm by 1 cm
.....All the same size?	Most grains are similar in size: about 1 cm.
Grain shapes	Medium Angular
Strength	Very strong.
Other Comments	

Interpretation: All these grains are the exact same color, as is the area in between each grain. In the schoolyard, we know that the color comes because the grains are coated with tar to make them stick together. All sedimentary rocks also have something that makes the grains stay together -- the "cement." Commonly, calcite or quartz form the cement in sedimentary rocks. However, even a few natural rocks are cemented by tar in places where oil and tar naturally seep to the surface (common along the California coast, especially at beaches near Santa Barbara). <Example photo of this environment>

Location	east of South Hall, UC Berkeley
Colors	Most grey with a slight brownish tint. Larger grains are darker grey with a

Colors	slight bluish tint. Very few white, milky looking grains.
.....All the same color?	No.
Grain Size	
.....Minimum grain size	0.2 cm
.....Maximum grain size	1 cm
.....All the same size?	A pretty wide range in sizes.
Grain shapes	Angular (most grains, especially the biggest ones)
Strength	Very strong.
Other Comments	Very rough surface.

Interpretation: In natural environments, landslides can produce this combination of angular fragments spanning a wide range of small size grains. Landslides are quick events that break the rocks apart but are not steady or long enough to round the grains. <Example photo of this environment>

Location	east side of McGlaughlin Hall, UC Berkeley
Colors	Mostly light grey, with some bluish grey and even whitish grey
.....All the same color?	No.
Grain Size	
.....Minimum grain size	2 cm
.....Maximum grain size	6 cm
.....All the same size?	Mostly. Most Grains are about 4 cm.
Grain shapes	Rounded
Strength	Very strong.
Other Comments	Each of the little rocks within this picture are rounded and smooth.

Interpretation: The large size of these grains means that something with a lot of energy moved them -- a rapidly moving river is a good bet. The fact that they are so smooth and rounded indicates that sat in the river for quite a long time. <Example photo of this environment>

Location	corner of Parker and College, near Emerson School, Berkeley
Colors	Overall, the rock is fairly light colored. Majority of grains are light grey (>60%).

Colors	~20% dark grey. ~10% white. A few rusty red-brown grains.
.....All the same color?	A very wide range of colors.
Grain Size	
.....Minimum grain size	0.1 cm
.....Maximum grain size	0.5 cm
.....All the same size?	Mostly. Most Grains are about 0.2 cm.
Grain shapes	Some grains Medium Rounded Some Medium Angular
Strength	Very strong.
Other Comments	This section of the concrete had a stamp stating that it was poured in 1962.

Interpretation: The small size of these grains means that they could have been in an environment with relatively low energy, but the medium rounded shape tell us that they sat there a long time and were reworked over and over again. In nature, we might find this combination at a beach. <Example photo of this environment>

Location	outside Art Studio building, UC Berkeley
Colors	About 50% milky white, 20% light grey, 25% dark grey. Some reddish grains (5%).
.....All the same color?	No.
Grain Size	
.....Minimum grain size	0.5 cm
.....Maximum grain size	1.5 cm
.....All the same size?	Mostly. Most Grains are about 0.75 cm.
Grain shapes	Rounded, with a few medium rounded grains.
Strength	Very strong.
Other Comments	Some of the grains have fallen out, leaving behind rounded holes in the pavement.

Interpretation: These grains are about the size of a fingernail. Try to imagine how fast water would have to be flowing to move a pebble that size (think of a playing with a hose or sink faucet). It couldn't be too slow, but wouldn't have to be too fast either. A small creek would fit the bill. The round grains again indicate that it sat in the bed for a very long time. <Example photo of this environment>

Location	corner of Parker and College, near Emerson School, Berkeley
	Brownish-red, light orange, very light grey,

Colors	greenish grey, turquoise, dark grey with a purple tint.
.....All the same color?	No! Multi-colored.
Grain Size	
.....Minimum grain size	0.5 cm
.....Maximum grain size	1.5 cm
.....All the same size?	Mostly. Most Grains are about 1 cm.
Grain shapes	Rounded
Strength	Very strong.
Other Comments	Some of the grains have fallen out, leaving behind rounded holes in the pavement.

Interpretation: The size and shape of the grains in this rock are similar to the one above, so we can assume that it came from a similar river environment. The wide range of colors is the most notable part of this rock, indicating that it is made up of a wide range of rock types. In nature, a river moves pieces of rock from all of the area upstream of it within its watershed. To get so many different types of grains, this rock needs to have come from a river with a large drainage basin having a wide range of rock types. <Example photo of this environment>
