

Rock Cycle: The Story of a Rock

Teachers: This lesson contains three classroom activities with discussion questions related to the AFG video clips about the rock cycle. These parts may be used as an activity as part of a unit on rocks, or it might be used as an assessment for a rock unit.

Note: You can access and view the video clips used in this lesson in the Teacher Resources section of the AFG Web site (www.pbs.org/americanfieldguide/teachers).

Grade Level: 7-9

Background Information

One of the primary responsibilities of a geologist is to explain how a rock came to be. Using observation of the rock itself, where the rock is located, and a little geologic knowledge, a geologist can recreate a scene in a geologic story.

For example, in central Oregon there is a rock called the Goose Rock Conglomerate. The name of the rock is my first clue to the story of its origins. By calling it a conglomerate, the geologist is limiting the options. It is a sedimentary rock, not igneous or metamorphic. It is made of pebbles or small stones, formed from other rocks. It existed at the surface of the earth in a watery environment and that water had high energy. Either there was a lot of wave action or it was formed in a fast-moving river or stream or as part of a debris flow or landslide. Further investigation of the rock shows me that the pebbles are roughly 2 inches in diameter and well rounded. They are held together by a cement. This helps me to fill in the details of my story. Now I know that these were likely formed in a beach or river mouth environment because the rocks have been well sorted. In a debris flow or landslide, sand, pebbles and boulders all slide together. With a little more regional analysis, I find that I am in the Cretaceous period and that there are deeper ocean water sediments to the west. Now if I close my eyes while standing on the Goose Rock Conglomerate in central Oregon (200 miles from the current coast) I can picture myself on a rocky, wave-lapped beach akin to Pebble Beach. Dinosaurs such as Triceratops rustle through the flowery shrubs to my east, velociraptors swoop through the sky above, and ichthyosaurs and large ammonites are swimming as the sun sets to the west.

Story telling can be used to help students understand the changes a rock undergoes as it passes through the rock cycle. In this activity, students will use more creative story telling to describe the rock cycle. This activity is intended to be used at the end of a unit on rocks and minerals, and may even constitute an assessment of the unit.

Curriculum Suggestion

This lesson combines knowledge of the scientific content about the rock cycle with creative writing and art. You may want to work with language arts and art teachers to present it as an integrated lesson. For instance, if English classes are learning to write narratives, you might require their story to be in the form of a narrative. Or, they might write the story and be graded on writing style by their English teacher and on scientific content by the science teacher.

Related National Standards

This lesson addresses the following National Content Standards found at <http://books.nap.edu/html/nses>

Content Standard D: As a result of their activities in grades 5-8, all students should develop an understanding of

- Structure of the earth system
 - Some changes in the solid earth can be described as the 'rock cycle.' Old rocks at the earth's surface weather, forming sediments that are buried, then compacted, heated, and often re-crystallized into new rock. Eventually, those new rocks may be brought to the surface by the forces that drive plate motions, and the rock cycle continues.

Content Standard D: As a result of their activities in grades 9-12, all students should have develop an understanding of

- Geochemical cycles
 - The earth is a system containing essentially a fixed amount of each stable chemical atom or element. Each element can exist in several different chemical reservoirs.
 - Movement of matter between reservoirs is driven by the earth's internal and external sources of energy. These movements are often accompanied by a change in the physical and chemical properties of the matter.
- Origin and evolution of the earth system
 - Interactions among the solid earth, the oceans, the atmosphere, and organisms have resulted in the ongoing evolution of the earth system.

Extension Web Sites from PBS

- **Newtons Apple – Mount Rushmore**
<http://www.pbs.org/ktca/newtons/11/mtrushmr.html>
This is an activity about weathering and erosion and how they affect different types of rocks.
- **Newtons Apple – Spelunking**
<http://www.pbs.org/ktca/newtons/14/spelunk01.html>
This site includes an activity about weathering in caves.
- **Standard Deviants – All About Geology**
http://www.pbs.org/standarddeviantstv/transcript_geology.html
Check out this site for a basic text on different types of rock formation.
- **Standard Deviants – All About Geology (classroom resources)**
http://www.pbs.org/standarddeviantstv/class_res_geology.html
This site contains activities using rocks. It is especially good for younger students.
- **Nova – The Curse of T. Rex**
<http://www.pbs.org/wgbh/nova/trex/dig/>
If students think they understand the rock cycle, they can go here to test their knowledge!

Activity 1: The Rock Story**Time allotted:**

One class period plus time to complete assignment as homework

Materials:

- Geologic Dictionary, textbooks, and pictures of rocks and rock specimens are helpful

Objectives

- Students will describe the changes undergone by rocks during the rock cycle.
- Students will describe the processes that occur during the rock cycle.
- Students will use creative writing to illustrate their understanding of the rock cycle.
- Students will develop an understanding of the interconnectedness of the rock cycle.

**Watch the AFG Video Segment: "Mountain Building in the Desert Part 3"**

Start at the beginning and watch through to the end.

**Watch the AVG Video Segment: "Geology of the Gem State"**

Start at 'in the beginning, all was igneous.' And stop after hearing 'and change the shape from this nice rock to this metamorphic rock'

Note: You can access and view the video clips used in this lesson in the Teacher Resources section of the AFG Web site (www.pbs.org/americanfieldguide/teachers).

From these videos, have your students discuss the transformation from one rock type to another. As a group, make a draft of the rock cycle (see example at: <http://www.cnwl.igs.net/~gvss/gca2a0/website/rock.htm>) using the rocks mentioned in the video. Use the following questions to help lead your discussion.

Discussion Questions for Video Segments

- In the first video, the geologist illustrates how granite can be turned into gneiss. What are some things that might happen to gneiss?
- Does granite have to turn into gneiss? What else might happen to it?
- In the second video, they showed a sedimentary rock turning into a metamorphic rock. Does it have to become a metamorphic rock?
- Is the rock cycle a one-way cycle?

Classroom Activity

The purpose of this activity is for students to write a creative story about a rock as it goes through the rock cycle. This can be done in many formats. Some students have written it as a detective story, a story about someone in the witness protection program, a story about teen angst (so many forces pulling and pushing), a love story, etc. The possibilities are endless. You may want to preface this by reading part of *A Rock Grows Up: The Pacific Northwest Up Close and Personal* by Randi and Mike Goodrich to illustrate how one might personify a rock (search on Amazon.com to order a copy). This story tells of a young rock, coming up through a subduction zone and being exposed to different forces on the Earth's surface. It is written for fifth graders and is illustrated by a high school student. See the student directions for more specific details.



Watch the AVG Video Segment: "Hiking in Canyon Sin Nombre"

Students may watch this segment after writing their stories. Start at 'So Canyon Sin Nombre translates...' and stop after hearing 'mere few years for a geologist.'

Discussion Question

- How can rocks tell a geologic story?

Note: You may wish to compare different types of conglomerates. The one in the video resulted from a flash flood. See the introduction for another type of conglomerate. One way that the Canyon Sin Nombre Conglomerate is different from the Goose Rock Conglomerate is that it has a wider variety of grain sizes. Note cobbles bigger than a fist mixed with smaller pebbles. These clues are invaluable to geologists in interpreting geologic stories.

Suggested Assessment

Score each of the following categories on a scale from 0-4

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4 = Very well done

3 = Generally good

2 = Needs work

1 = Poor

0 = Not enough to grade

Category	Points
Proper and liberal use of terminology (magma vs lava; intrusive/extrusive etc.)	
Accurate and thorough description of the processes and conditions that cause you to change	
Good physical description of what you would look like at each stage of your rock cycle and the proper name that would be given at each phase	
Creativity	
Total Points:	

Activity 2: Rock Around the Rock Cycle

Time allotted:

45 minutes

Materials:

- Paper (Butcher paper, Poster Paper, Construction paper, etc.)
- Markers or crayons

Objectives:

- Students will show connections between different stages of the rock cycle by making a diagram.
- Students will illustrate a particular pathway a rock can take through the rock cycle.

Classroom Activity

Once students have written their story, they can illustrate it. Some will chose to draw a direct copy of the rock cycle diagram (see an example at <http://www.cnwl.igs.net/~gvss/gca2a0/website/rockd.htm>) and then will show their rock’s pathway while others will be more creative. See the student instructions for more details.

Suggested Assessment

Score each of the following categories on a scale from 0-4

- 4 = Very well done
- 3 = Generally good
- 2 = Needs work
- 1 = Poor
- 0 = Not enough to grade

Category	Points
Does it contain all the elements and processes necessary for your rock to complete its journey?	
Does it contain all the correct rock names in the right places?	
Is it neat and easy to read?	
Creativity	
Total Points:	

Activity 3: Identifying Rocks (optional)**Time Allotted:**

15 minutes

Materials:

- Rock samples or pictures of rocks

Objectives:

- Students will identify rocks.
- Students will match rocks with the appropriate phase of the rock cycle.
- Students will show how certain rocks can become other rocks.

Classroom Activity

This part of the lesson may be done in one of several ways.

1. Have students find rocks to glue onto their posters to illustrate the different phases of the rock cycle.
OR
2. Have students choose from a collection of rocks to insert rocks into their posters. You might request that they design places on their posters for the rocks that don't require them to glue to rocks to the poster. For instance, they might design little shelves or include plastic baggies, and then they can display your rocks and easily return them.
OR
3. Use this as a mini-assessment for your rock unit. Ask students to choose three rocks from your collection that illustrate their story (make one sedimentary, one igneous, and one metamorphic). You can grade them on the accuracy of their rock identification. Do they get the right names on the right rocks? Do they at least identify sedimentary, igneous, and metamorphic rocks correctly?

Related Web Sites

- **Igneous Rock Identification Exercise**
<http://geology.csupomona.edu/alert/igneous/ignrxs.htm>
This site provides detailed information about identifying and classifying igneous rocks. It also includes similar information for metamorphic rocks and minerals.
- **JMU Geology Department Geologic Web Sites**
<http://csmres.jmu.edu/geollab/Fichter/Fichter/websites.html>
A collection of web sites with a wealth of information about rocks and rock identification.

The Rock Cycle: Student Instructions

Activity 1: The Rock Story

In this activity, you will use creative storytelling techniques to show your understanding of the rock cycle. You should choose a type of rock and determine what might happen to it as it undergoes geologic changes. Then, think of a way to explain this in story form. You might give your rock a name and describe his/her adventures. You might write it as a mystery. There are many frameworks you might choose to use. Be creative and be sure you include the scientific information necessary to explain what happens to your rock. Your story will be graded on the following components:

- Proper and liberal use of terminology (magma vs lava; intrusive/extrusive etc.)
- Accurate and thorough description of the processes and conditions that cause you to change
- Good physical description of what you would look like at each stage of your rock cycle, and the proper name that would be given at each phase.
- Creativity

Suggestions for the rock cycle aspect of your story.

This outline is an example of the changes your rock might undergo. You can adjust it if you like, or you are welcome to use this format. Of course your story might start at any point of the rock cycle but should include all the possible phases of the rock cycle. This is the type of information that you should be sure to include!

I. Igneous Rocks

A. You start as magma. Do you stay deep within to cool, or do you come to the surface.

B. Cooling Rate

- Fast or Slow
- Large or small crystals, or no crystals at all
- Are there any gases trapped within?

C. What is your overall appearance. What would you be called at this phase of your life.

II. Sedimentary Rocks

A. You are being broken into smaller pieces and carried away

- What are these processes called?
- What is causing the breakdown? (winds, glaciers, rivers, waves?)
- What is carrying you away?
- Where are you going
- Where did you end up

B. You are surrounded by other rock fragments

- Are all of the same size, shape and composition?
- What happens next, are you reworked or buried immediately?

C. You become a sedimentary rock

- What changed you into a sedimentary rock
- Describe your overall appearance and give your self a name
- Explain how you have changed since your days as an igneous rock

III. Metamorphic Rocks

A. What occurs for you to change into metamorphic rock?

- What factors are involved?
- Where will this change occur?
- How do you get there?

B. What do you look like now?

- i. Foliated or non-foliated
 - ii. Crystalline or non-crystalline?
 - iii. What would your friends call you?
 - iv. How are you different from sedimentary and igneous rocks
- IV. Explain what might happen next.

Activity 2: Rock Around the Rock Cycle

Diagram your rock story in a rock cycle form. To review basic rock types and to see a basic rock cycle diagram, go to <http://www.cnwl.igs.net/~gvss/gca2a0/website/rock.htm>. However, your design should illustrate your rock story. Therefore, all the connections on the rock cycle may not be relevant in your diagram. Do be sure to include specific rock names on each part of the diagram and show what happens to your rock. Also, illustrate what else could happen to your rock (e.g. are there shortcuts it could take, but doesn't take in your story). Be creative and remember that this diagram should illustrate the story you wrote. Illustrate your rock cycle diagram to show the environment surrounding your rock and to show the forces acting upon it.

Your rock cycle diagram will be graded on the following components:

- Does it contain all the elements and processes necessary for your rock to complete its journey?
- Does it contain all the correct rock names in the right places?
- Is it neat and easy to read?
- Is it creative?