

Exploring How Rocks Are Formed

Grade Level: 3-4

Purpose and Goals: In this lesson, students are introduced to the three types of rocks: igneous, sedimentary, and metamorphic. After receiving background information on the processes by which these rocks are formed, students are allowed to perform activities which will help them understand the conditions leading to rock formation.

Targeted Objective: Explain the three ways rocks are formed.

Background: Igneous rocks are made from cooled and hardened magma. Magma is the hot molten rock from deep inside the earth. Igneous rocks which formed inside the earth, like granite, are intrusive igneous rocks. They were pushed (intruded) into other rocks. They cool slowly and have crystals. Mountain ranges are often made of these kinds of rock. Other igneous rocks are called extrusive igneous rocks, or volcanic rocks. They were formed when magma came to the surface (lava) and cooled. Extrusive rocks cool rapidly and have fine grains. Basalt and obsidian (volcanic glass) are extrusive igneous rocks.

Sedimentary rocks are the bits and pieces of rocks that were eroded, or worn away and carried by wind, water, and ice large distances. These bits and pieces are deposited and form layers. Over many years, these layers become cemented together and become sedimentary rock. The type of sedimentary rock depends on the kind of material in its layers. Fine sediment (clay) forms shale, sand forms sandstone, pebbles make conglomerate, while seashells form limestone.

Metamorphic, or changed rocks, start as sedimentary or igneous rocks, then are remade into new forms by extreme heat and pressure. An example of metamorphic rock is slate, formed when shale is exposed to great heat and pressure. Other examples are gneiss (pronounced nice), formed from granite, and marble, formed from limestone. (This information has been copied as a student handout – Appendix 1)

Materials/Preparation:

For each student:

- A rock (from the classroom collection)
- Science notebook
- Hand lens
- Types of Rock information sheet (Appendix 1)
- Copy of the Rock Cycle (Appendix 2)
- Copy of the Rock Cycle Song (Appendix 3)

For each group of 4 students:

- One half-cup peanut butter
- 12 crackers
- Plastic knife and spoon

12 pieces of saltwater taffy in three different colors
8 pieces of waxed paper
4 candy molds

For the class:

Chart tablet
Marker
Samples igneous, sedimentary, metamorphic rocks
Hot plate
Equivalent of 2 cups of almond bark (to melt)
Large spoon

Procedure:

1. Distribute Science notebooks, Types of Rock information sheets, and Rock Cycle diagrams. Ask the students to turn to a clean page in their Science notebooks and write today's date. Discuss with the students the concept that rocks vary in appearance according to how they are formed. Go over the information on the three kinds of rocks and how they are formed. Make a class chart with the names and definitions of the three types of rock and examples of each. Have the students copy the information into their Science notebooks. Look at the Rock Cycle diagram. Talk about what a "cycle" is, and how one kind of rock can become another kind of rock.
2. Have each student get his or her rock from the class collection and examine it with a hand lens. Ask them to think about which of the three types of rocks they have. Visit the ISM Geology Online GeoGallery and look at the rocks. Ask: "Is your rock shown on the Web site? What is your rock's name?" (this could have already been determined if you also did the Exploring Rocks lesson), "What type of rock is your rock?" (The rocks on the Web site are listed according to type.). NOTE: It is good to have some books that also explore rock types. The best for identification purposes is: Mottant, A., R. Crispi, and G. Liborio. 1978. Simon & Schuster's Guide to Rocks & Minerals. New York: Simon & Schuster, Inc. (There is undoubtedly a new edition available.). Have the students put the rocks back in the classroom collection. Pass around samples of the three types of rocks and allow the students to examine them. If possible, have samples of slate, marble, and gneiss.
3. Edible Rocks Activity
Tell the class they are going to do an activity showing how the three types of rock are formed. Put the students in groups of four. Give four candy molds sprayed with cooking oil and a plastic spoon to each group. For the first part of the activity, allow the class to gather around the table as you melt the almond bark in a pan on the hot plate. Tell the students that the melted chocolate represents magma. Have them return to their groups, and take the container of "magma" to each group. Allow the students to spoon the melted mixture into their candy molds. While their "igneous rocks" cool, distribute the materials to make

sedimentary rocks (peanut butter, crackers, knives), and metamorphic rocks (taffy, waxed paper). The students make cracker and peanut butter stacks to illustrate the layers in their “sedimentary rocks”. Each student should then take three pieces of different colored taffy, unwrap them, and stack them on a piece of waxed paper. The student then places the other piece of waxed paper on top of the stack and presses down hard to make “metamorphic rock”. To end the activity, call out the name of a rock type and have the students hold up the correct rock model they have made. They can then eat their rock creations.

Questions: Ask the students to write the answers to these questions in their Science notebooks:

1. How can an old rock become a new rock?
2. How is metamorphic rock formed?

Extensions:

1. Allow special needs students to orally answer questions or dictate their answers to other students who can scribe for them.
2. Do additional activities on the three types of rocks from these Web sites:
<http://www.coaleducation.org/lessons/sme/elem>
<http://www.rogersgroupinc.com/ourcommunities/rockology>
<http://www.utm.edu/departments/ed/cece/third/3L4.shtml>
3. **Language Arts:** Write a narrative story about how a rock is formed. Describe what happens to the rock as it goes through the processes that change it from one type of rock into another type. Throughout the story, describe how the rock feels as the changes are occurring. Use the following questions to help you write your story: Did you start as magma? (igneous rock). Are you on the surface (lava), near the surface, or deep beneath it? Do you cool fast or slowly? Do you have crystals? What do you look like?

Or—Are you sedimentary rock? You are being broken into smaller pieces and carried away. What is this called? What is causing it? What is carrying you away? Where are you going? Where do you end up? You are surrounded by other rock fragments. Are they the same type and size? Are more piling up above you? You are now sedimentary rock. What changed you? What do you look like now?

Or—Are you changing? (metamorphic). What kind of rock are you at first? What changes must happen to you to turn you into metamorphic rock? Where will this change occur? How do you get there? What do you look like when you have changed?

Assessment:

- Science notebooks: Were questions answered thoroughly and did the answers show an understanding of the rock formation processes?
- Observation checklist for collaborative group work (Appendix 4).

- Edible rocks: Did the students show an understanding of rock formation as they made their edible rocks? Did they hold up the correct rocks when you called out the names?
- Culminating: Ask the students to make a drawing of the rock cycle, using arrows and these terms: sedimentary rock, igneous rock, metamorphic rock, heat and pressure, erosion.
- Optional: Have the students learn and perform the Rock Cycle song (Appendix 3).

Resources:

McGraw Hill Science 2002, Grade 3, Earth Science, Unit C, pp. C8-C9

Bones and Rocks Earth Science Activity Book, Bones and Rocks Kit, Bear Creek Toys

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

Rocks and Minerals/The Rock Cycle chart, Instructional Fair, TS Denison

Lesson Specifics:

Skills: Exploring, observing, making a model, analyzing, communicating.

Duration: Two or three class periods.

Group size: Any.

Setting: Classroom.

Illinois State Board of Education Goals and Standards:

11A: Know and apply the concepts, principles, and processes of scientific inquiry.

11B: Know and apply the concepts, principles, and processes of technological design.

12E: Know and apply concepts that describe the features and processes of the Earth and its resources.

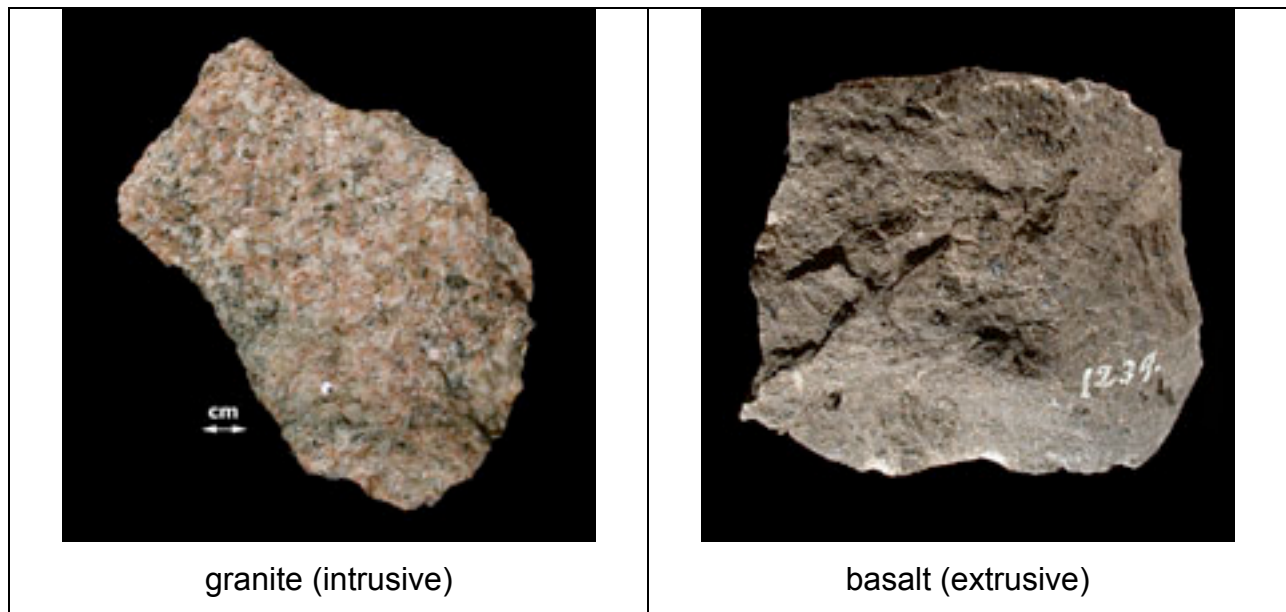
13A: Know and apply the accepted practices of science.

ADDITIONAL ONLINE RESOURCES

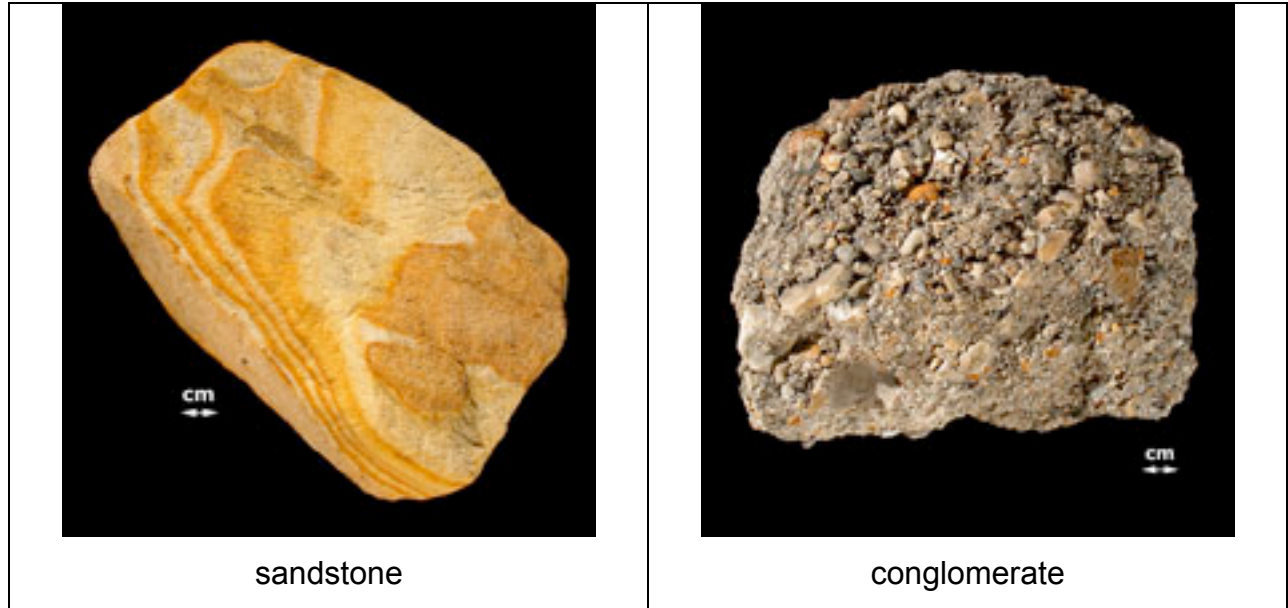
1. Online stores to purchase bagged rocks and minerals:
<http://www.rocksandminerals.com> <http://www.geoprime.com>
2. The Mineral Gallery: Web site with photos and information on mineral specimens, plus minerals to purchase: <http://mineral.galleries.com>
3. Free software download for MAC: Rocks! 1.0:
http://mac.tucows.fi/macteach_size.html
4. Rocks and Minerals links compiled by third grade at Arthur Elementary School:
<http://arthur.k12.il.us/arthurgs/rocklile.htm>
5. List of books and web site links on rocks and minerals:
http://eho.org/rocks_resource_list.htm
6. Educational outreach program: Mineral and Rocks Box test:
<http://dnr.state.il.us/mines/kdz3.htm>
7. Wonderful web site covering all areas of rocks and minerals study, as well as tips for rock collecting. Good lesson plans for elementary teachers: Rock Hounds:
<http://www.fi.edu/fellow/payton/rocks/index2.html>
8. More lesson plans and units from the Mineral Information Institute:
<http://www.mii.org/lessons.php>
9. Geomysteries: Located at Indianapolis Children's Museum web site (click on Kids): <http://www.childrensmuseum.org>
10. This Planet Really Rocks: award winning child-created geology project with games, facts, jokes, activities: <http://library.thinkquest.org/J002289>

Types of Rock

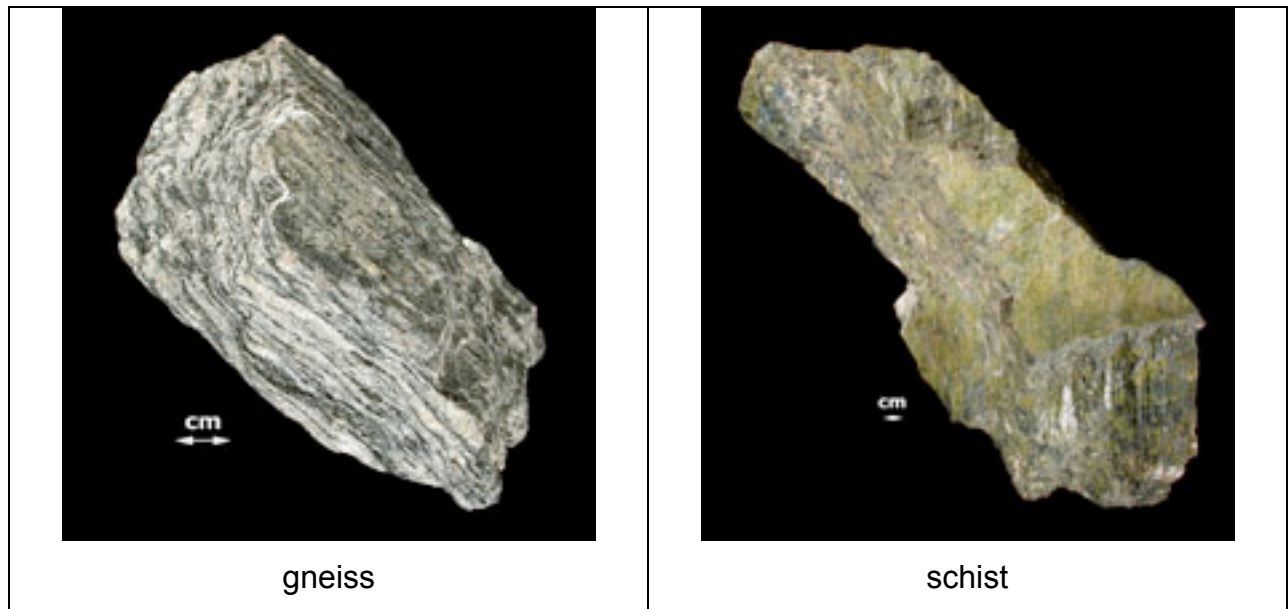
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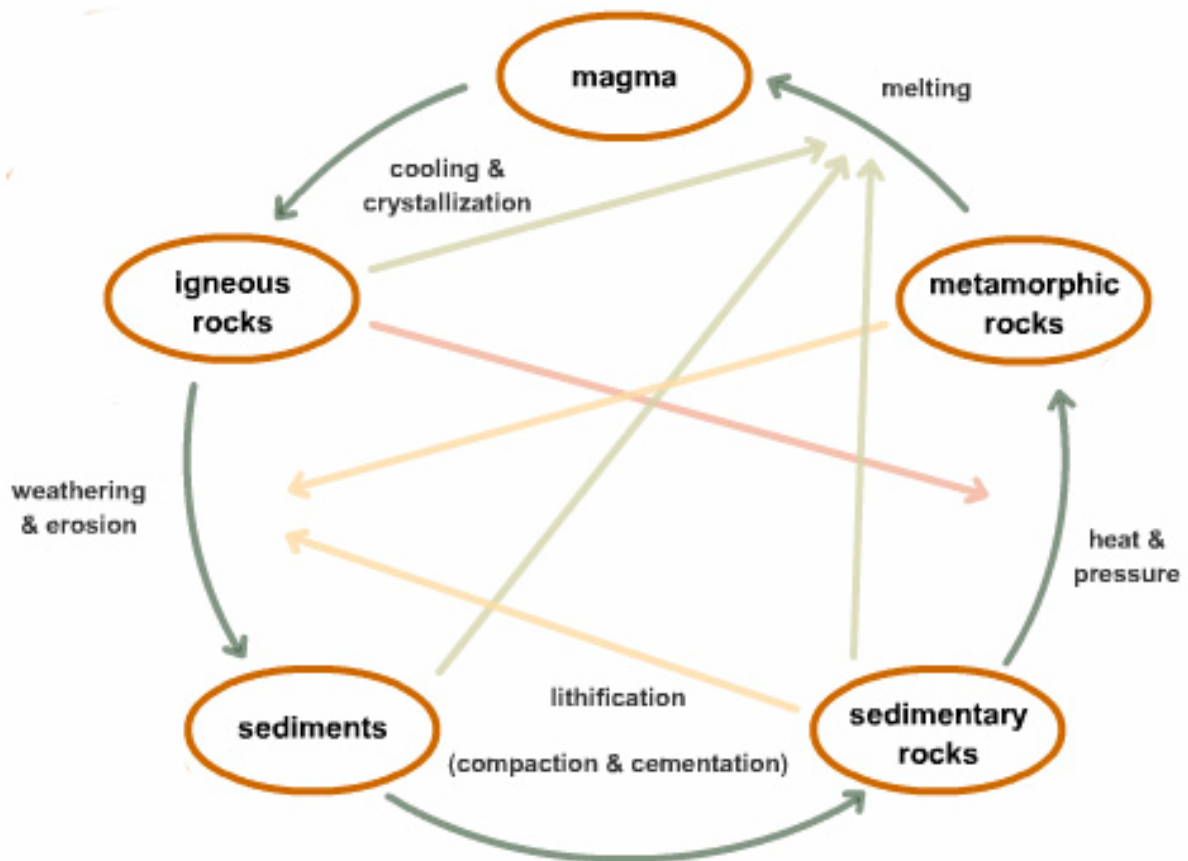
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The Rock Cycle



Rock Cycle Song

(Sing to the tune of “Row, Row, Row Your Boat”)

SEDIMENTARY Rock

Has been formed in layers
Often found near water sources
With fossils from decayers

Then there’s **IGNEOUS** rock
Here since Earth was born
Molten Lava, cooled and hardened
That’s how it is formed

These two types of rocks
Can also be transformed
With pressure, heat and chemicals
METAMORPHIC they’ll become

(Don’t forget to sing this as a “round”; after all, it is the Rock “Cycle”!)

Collaborative Work Skills: Science Group

Student Name _____

Date _____

CATEGORY	4	3	2	1
Contributions	Routinely provides useful ideas when participating in the group and in classroom discussion. A definite leader who contributes a lot of effort.	Usually provides useful ideas when participating in the group and in classroom discussion. A strong group member who tries hard!	Sometimes provides useful ideas when participating in the group and in classroom discussion. A satisfactory group member who does what is required.	Rarely provides useful ideas when participating in the group and in classroom discussion. May refuse to participate.
Focus on the task	Consistently stays focused on the task and what needs to be done. Very self-directed.	Focuses on the task and what needs to be done most of the time. Other group members can count on this person.	Focuses on the task and what needs to be done some of the time. Other group members must sometimes nag, prod, and remind to keep this person on-task.	Rarely focuses on the task and what needs to be done. Lets others do the work.
Working with Others	Almost always listens to, shares with, and supports the efforts of others. Tries to keep people working well together.	Usually listens to, shares with, and supports the efforts of others. Does not cause "waves" in the group.	Often listens to, shares with, and supports the efforts of others, but sometimes is not a good team member.	Rarely listens to, shares with, and supports the efforts of others. Often is not a good team player.
Attitude	Never is publicly critical of the project or the work of others. Always has a positive attitude about the task(s).	Rarely is publicly critical of the project or the work of others. Often has a positive attitude about the task(s).	Occasionally is publicly critical of the project or the work of other members of the group. Usually has a positive attitude about the task(s).	Often is publicly critical of the project or the work of other members of the group. Often has a positive attitude about the task(s).