Rock Detectives

Rock Identification
Time: approximately 90 minutes

Adapted from Fossils to Fuel 2 — An Elementary Earth Science Curriculum, developed for the Oklahoma Energy Resources Board, an agency of the State of Oklahoma.

GRADE LEVEL: 3, 5, and 6

SUBJECTS: Science

WONDER WHY…

Why do rocks look different from each other?

CONCEPT

Rocks are a natural, solid, nonliving material made of one or more minerals. Using a dichotomous key, rocks can be identified by physical properties such as color, texture, feel or grain size

TEACHER INFORMATION

For more Arkansas specific information explore the websites below. If these are no longer available, search the internet for current resources on Arkansas Geology.

https://www.geology.arkansas.gov/geology/general-geology.html
http://www.encyclopediaofarkansas.net/encyclopedia/entry-detail.aspx?search=1&entryID=2221
http://www.encyclopediaofarkansas.net/encyclopedia/entry-detail.aspx?search=1&entryID=401
http://www.encyclopediaofarkansas.net/encyclopedia/entry-detail.aspx?search=1&entryID=6011
http://cber.uark.edu/files/Executive_Summary_Revisiting_the_Economic_Impact_of_the_Fayetteville_Shale.pdf

Earth's outer layer, or crust, is made mostly of rock. Rocks are naturally occurring solid material consisting of one or more minerals. Rock identification is based on observable physical properties such as: color, feel/texture, shape, and grain size.

Rocks occur in three major groups based on how they are formed.

- **Igneous rocks** are formed underground as magma (melted rock) which cools, and turns into a solid called igneous rock. Igneous rocks can also be formed on the surface of the earth when molten lava from volcanoes cools.

- **Metamorphic rocks** form when existing sedimentary or igneous rocks are subjected to increased heat and pressure inside the Earth's crust.

- **Sedimentary rocks** form from sediments. Sediment is created by the erosion, or breaking up of, igneous, metamorphic or sedimentary rocks. As these sediments and other materials, such

as plants and animals, are buried deep below ground they are subjected to increased heat and pressure. This increased heat and pressure changes the sediment to sedimentary rock. Some sedimentary rocks are also formed by chemical processes that occur in water, such as precipitation and evaporation.

Over many years igneous, metamorphic and sedimentary rocks are formed and then worn away by erosion again and again. This continuous process that rocks go through is called the **rock cycle**. As seen in Figure 1, (***see also printable master of rock cycle***) the three types of rocks can change from one type to another at different points within the rock cycle.

Geologists often classify areas as either uplifts (high areas) or basins (low areas). As the uplifted areas are subjected to erosion, the material that is eroded (sediment) is washed off the uplifts and collects in the adjacent low areas or basins, forming thick layers of sediment over time that later may be transformed by heat and pressure into sedimentary rocks.

Sedimentary rocks, like sandstone and limestone, are the most likely rocks to contain crude oil and natural gas trapped in the rock pores. Certain areas of Arkansas contain layers of sedimentary rocks, making it a potential location for rich oil and gas deposits.

In this activity, students will become rock detectives and use physical properties to classify rocks.

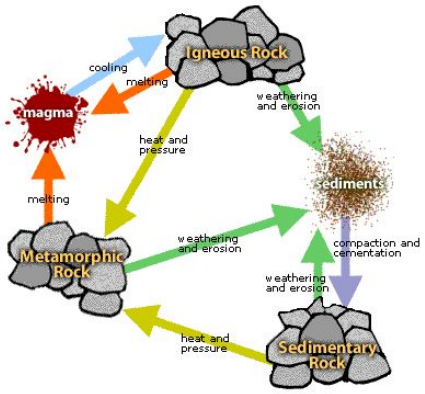


Figure 1

MATERIALS

- Collection of 10 rocks per group (Number rocks for identification activity; **See Student Handout 2** for a list of rocks that should be used. If these examples are not available, different rocks may be substituted for those listed. If rocks are substituted, the **Dichotomous Key** and **Rock Identification Chart** must be changed. These Handouts are in a Word document can be edited to reflect the changes.)
- 2 magnifying lenses per group
- 1 per group – **Rock Detective Lab Sheet Student Handout 1**
- 1 per student – **Rock Identification Dichotomous Key Student Handout 2**
- 1 per student – **Rock Identification Chart Student Handout 3**
- 1 per student – **Rock Identification Conclusion Student Handout 4**

- One or more books on rocks and rock collecting.
    - Suggested titles:
      Let's Go Rock Collecting, By: Roma Gans, Illustrated by: Holly Keller, ISBN-13: 978-0-06-445170-3
      If You Find a Rock by Peggy Christian (Author), Barbara Hirsch Lember (Photographer) 13: 978-0152063542
      Rocks: Hard, Soft, Smooth, and Rough Natalie M. Rosinsky (Author) , Matthew John (Illustrator) 13: 9781404803343
      The Rock Factory: The Story About the Rock Cycle (Science Works) by Jacqui Bailey (Author) , Matthew Lilly (Illustrator) 13: 978-1404819979 ***Jump into Science: Rocks and Minerals*** by Steve Tomecek (Author) , Kyle Poling (Illustrator) 13: 978-1426305382
      Looking at Rocks (My First Field Guide) by Jennifer Dussling (Author) , Tim Haggerty (Illustrator) 13: 978-0448425160

PROCEDURE

SAFETY:

Before the lab begins stress the following safety rules with students:
Keep rocks on the table or desktop.
Do not put rocks in your mouth.
Wash your hands after handling rocks.

1. Introduce the lesson with background information about the rock cycle. Depending on the level of your students, you may use one of the following videos. If these web sites are no longer available search the internet for information on the rock cycle.

   http://studyjams.scholastic.com/studyjams/jams/science/rocks-minerals-landforms/rock-cycle.htm

   http://www.youtube.com/watch?v=ihfKNRdlE2E

   http://www.neok12.com/php/watch.php?v=zX616a577c597f7c784c720a&t=Types-of-Rocks

   https://www.youtube.com/watch?v=pm6cCg_Do6k

   http://www.schooltube.com/video/503ca205aae459f47494/The-Rock-Cycle

   Display **Figure1 – Rock Cycle** and discuss possible changes in rocks that might occur.

2. Divide students into groups. Give each group a container of 10 numbered rocks. Use the rocks listed on the chart or select others that you prefer. **Student Handout 2: Dichotomous Key is written for the rocks in Student Handout 3: Rock Identification Chart. If you change the rocks, you must also change the dichotomous key and the identification Handouts.**

3. Students will place all the rock samples out on their table. Have students suggest how they will sort the rocks using physical properties. Guide their discussion so their results include at least the four properties listed in the Rock Identification Chart. Others may be added to meet specific AR frameworks. Have groups share and discuss results.

4. Distribute a copy of **Student Handout 1—Lab Sheet, Student Handout 2— Dichotomous Key, Student Handout 3— Rock Identification Chart** and go over the procedure with students.

5. Students will select one rock from the rock samples, and then read carefully through the Rock Identification Dichotomous Key to classify and name the rock.

6. Record the rock number on the Rock Identification Sheet in the blank next to the correct name of the rock.

7. Record the physical properties of the rock.
   The following web sites may be helpful for more background. If these web sites are no longer available, conduct an internet search for physical properties of rocks.

   http://www.rocksandminerals4u.com/properties_of_minerals.html
   http://www.geo.utexas.edu/courses/303/303_lab/MineralOverhead.pdf

8. Repeat steps 5-7 until all rock samples have been classified. Have students share their results with the class. Correct any errors in classification and discuss how misclassification occurred.

EXTENSION:

1. Write a short story from the viewpoint of a particular sedimentary, igneous or metamorphic rock as you travel through the rock cycle moving from one type of rock to another.

2. Develop a poster about the rock cycle and determine how igneous, sedimentary and metamorphic rocks are formed.

3. Copy the rock cycle parts (words, phrases, pictures) on paper plates and arrows so students can manipulate them to create the rock cycle. Use this activity as a formative assessment to determine that students understand the rock cycle.

VOCABULARY

crude oil – oil in its natural liquid state (a mixture of gases, oil, and water) as it comes from the ground

dichotomous key – a key used for the identification of objects based on a series of choices

granular – containing small, hard particles or grains

igneous rocks - form when the magma or lava (melted rock) cools and turns solid

layering – horizontal layers or lines

metamorphic rocks - form when existing rocks are exposed to increased heat and pressure inside the Earth's crust.

mineral - a solid inorganic material found in the Earth's crust; the building blocks of rocks

natural gas - colorless, odorless gas found in the Earth

physical property – what can be seen or measured

pore – openings or spaces within a rock

rock - the solid part of earth made of one or more minerals

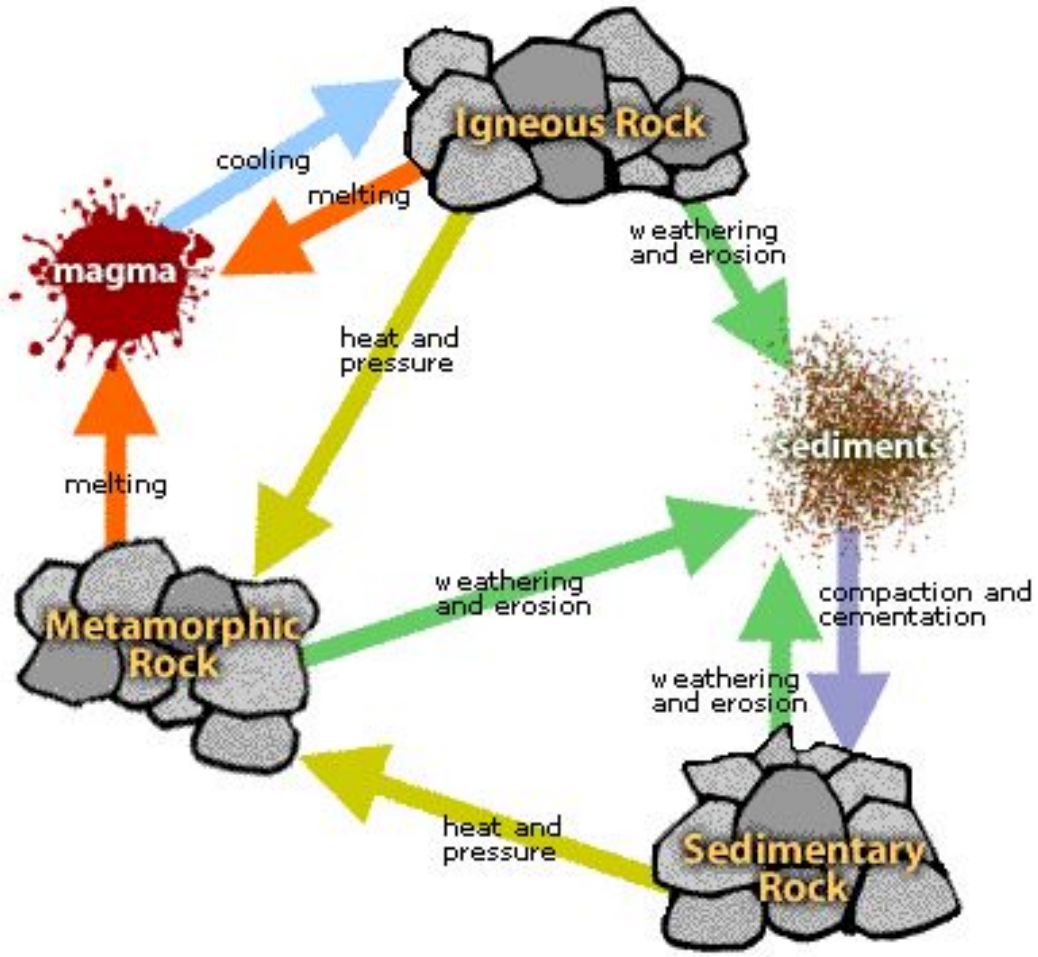
rock cycle - the series of events that rocks, over time, go through that changes them from one type of rock to another.

sedimentary rocks - form when sediments and other materials press together and harden

texture – characteristic of a rock that you can see and feel

STUDENT HANDOUTS – (See Arkansas Energy Rocks web site for printable student handouts in Word documents. Teacher answer keys for the student handouts follow.)

Rock Detectives
Rock Cycle
Figure 1



Name_____ Date_____

ROCK DETECTIVE
Student Handout 1
Lab Sheet

WONDER WHY…

Why do rocks look different from each other?

CONCEPT

Rocks are a natural, solid, nonliving material made of one or more minerals. Using a dichotomous key, rocks can be identified by **physical properties** such as color, texture, feel or grain size.

MATERIALS FOR ACTIVITY

- 1 collection of 10 rocks per group
- 2 magnifying lens per group
- 1 Rock Identification Sheet per student
- 1 Rock Identification Dichotomous Key per student

SAFETY

- Keep rocks on the table or desktop.
- Do not put rocks in mouth.
- Wash hands after handling rocks.

PROCEDURE

1. Place the rock samples out on the table.
2. Select one rock from the rock samples.
3. Read carefully through the Rock Identification Dichotomous Key to classify and name the rock.
4. Record the rock number on the Rock Identification Sheet in the blank next to the correct name of the rock.
5. Record the physical properties of the rock.
6. Repeat steps 2-5 until all rock samples have been classified.
7. Share your results with the class.

Student Handout 2
Rock Identification
Dichotomous Key

1. What is the overall color of the rock?
    a. Rock is black in color .....Go to step 2
    b. Rock is not black .....Go to step 3

2. Is the rock glassy or not?
    a. Rock is smooth and glassy .....Obsidian (Igneous)
    b. Rock is not glassy .....Go to step 4

3. Inspect the rock carefully **without** the hand lens. Are there large holes or pores?
    a. Rock has visible holes or pores .....Go to step 5
    b. Rock has small or unseen pores .....Go to step 6

4. Does the rock show layering or is it more blocky?
    a. Rock is layered .....Shale (Sedimentary)
    b. Rock is not layered it is more blocky .....Coal (Sedimentary)

5. What is the overall color of the rock?
    a. Rock is grey or light grey .....Pumice (Igneous)
    b. Rock is reddish-brown or dark brown .....Scoria (Igneous)

6. Look closely at the rock **with** a hand lens. Does the surface sparkle or have crystals?
    a. Rock sparkles or appears crystalline .....Go to step 7
    b. Rock is dull and doesn't sparkle .....Go to step 8

7. Look carefully at the rock. Is the rock multicolored or not?
    a. Rock color is multicolored or speckled .....Go to step 9
    b. Rock color is the same throughout .....Marble (Metamorphic)

8. Look closely at the rock **with** a hand lens. Are the grains large or small?
    a. Rock grains are pebble size and/or mixed sizes ..... Conglomerate (Sedimentary). b. Rock grains are mostly sand size .....Sandstone (Sedimentary)

9. Does the rock show layering of grains?
    a. Rock grains are in layers .....Gneiss (Metamorphic)
    b. Rock grains are scattered with crystals .....Granite (Igneous)

Rock Detectives
Rock Identification Chart
Student Handout 3
Teacher Key

IGNEOUS	Color: **Black** Feel/Texture: **Glassy, smooth** Grain Size: **Cannot see grains** **OBSIDIAN # 6**	Color: **Light colored** Feel/Texture **Many holes or pores** Grain Size: **Fine grained** **Pumice 7**
	Color: **Reddish Brown – Dark Brown** Feel/Texture" **Many holes of pores** Grain Size: **Fine grained** **SCORIA # 9**	Color: **Variable** Feel/Texture: **Crystals visible** Grain Size: **Coarse** **Granite# 4**
SEDIMENTARY	Color: **Grey – Dark grey – black** Feel/Texture: **Thin layers visible** Grain size: **Fine to very fine grained** **SHALE # 10**	Color: **Variable** Feel/Texture: **Crystals visible** Grain Size: **Coarse** **SANDSTONE # 8**
	Color: **Black – Dark grey** Feel/Texture: **Blocky** Grain Size: **Fine grained** **COAL # 1**	Color: **Variable** Feel/Texture: **Grainy – rough** Grain size: **Larger than sand size grains** **CONGLOMERATE # 2**
METAMORPHIC	Color: **Variable** Feel/Texture: **Rough** Grain size: **Fine grained** **MARBLE # 5**	Color: **Variable** Feel/Texture: **Layers of crystals or color** Grain size: **Fine to coarse** **GNEISS # 3**

Name_____ Date _____

ROCK DETECTIVE

CONCLUSION
STUDENT HANDOUT 4
Teacher Key

1. What properties did you use to classify your rocks?

   Possible answer: Physical properties such as, color, grain size and composition.

2. Do all rocks of a specific rock type have the same properties?

   Possible answer: No, for example, sedimentary rocks can vary in color, texture, and grain size.

3. In what type of rock do you think crude oil and natural gas are most likely to be found? Why?

   Possible answer: Sedimentary rocks -- because of the three rock types they are the most likely to contain pores and connected pores where oil and natural gas can be trapped and stored.