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Sedimentary Rocks
(Introduction)

Abstract: During this introductory lesson the students will learn about sediments and how to classify rocks.

Grade Level: 4th Grade

Utah Elementary Core Curriculum Standards:
Topic: Sediments/Classifying Rocks

> **Standard 3:** Students will understand the basic properties of rocks, the processes involved in the formation of soils, and the needs of plants provided by soil.
>
> **Objective 1:** Identify basic properties of minerals and rocks.
>
> - Describe the differences between minerals and rocks.
> - Observe rocks using a magnifying glass and/or field microscope and draw shapes and colors of the minerals.
> - Sort rocks by appearance according to the three basic types: sedimentary, igneous and metamorphic (e.g., sedimentary–rounded-appearing mineral and rock particles that are cemented together, often in layers; igneous–with or without observable crystals that are not in layers or with or without air holes or glasslike; metamorphic – crystals/minerals, often in layers).
> - Classify common rocks found in Utah as sedimentary (i.e., sandstone, conglomerate, shale), igneous (i.e., basalt, granite, obsidian, pumice) and/or metamorphic (i.e., marble, gneiss, schist).

In Class Instructional Time: 60 minutes

Terminology:

Minerals- Minerals can be pure substances (elements) or combination of substances (compound). Minerals are the raw materials of rocks.
Sedimentary- Materials (known as sediment) consist of sand, mud, bodies of animals, shells, and other materials.
Igneous- Rocks are formed from minerals that have melted deep within the Earth.
Metamorphic- Rocks are formed from igneous, sedimentary, or other metamorphic rocks which contain minerals that have been changed by heat, pressure, or chemical action.

Intended Learning Outcomes:

- Students will observe objects (Utah rocks and minerals) at Emigration Creek.
- Students will use a classification system.
- Students will understand science information.

Background:

- Minerals can be pure substances (elements) or combination of substances (compound). Minerals are the raw materials of rocks. Rock types are characterized by the types of minerals present in their relative size, and the processes it takes for the rocks to form. Heat, pressure, and time are the most important of these processes.
- Some rocks may contain minerals in the form of crystals. Crystals can be small or large. The size of the crystals in a rock depends on how fast the rock cooled. The faster the rock was cooled, the smaller the crystal formation: the slower the rock was cooled, the larger the crystals.
- Igneous rocks are formed from minerals that have melted deep within the Earth. These melted minerals are called magma. As magma is pushed to the surface of the Earth, the minerals begin to cool and harden. Different igneous rocks are formed depending on the presence of different minerals and how fast the magma cools. Some igneous rocks include pumice, obsidian, and basalt.
- For thousands, even millions of years, little pieces of our earth have been eroded--broken down and worn away by wind and water. These little pieces of the earth are washed downstream where they settle to the bottom of the rivers, lakes, and oceans. Layer after layer of eroded earth is deposited on top of each. These layers are pressed down more and more through time, until the bottom layers slowly turn into rock. Nearly 75 percent of the land area of the Earth is covered with sedimentary rock. Sedimentary rocks include limestone, shale, sandstone, and breccias.
- Metamorphic rocks are formed from igneous, sedimentary, or other metamorphic rocks which contain minerals that have been changed by heat, pressure, or chemical action. Strong heat and pressure inside the Earth can cause minerals in rocks to change.

Materials:

For each group of 4-5 students:

- Samples of as many igneous, sedimentary, and metamorphic rocks as possible (collected at Emigration Creek field trip)
- Magnifying glass
- Field microscope

Assessment of Prior Knowledge:

A K-W-L should be used to assess their knowledge of classifying rocks and sediments. This form of assessment shows what the student already **K**now, **W**ant to know and what they

have **L**earned through the lesson. Whether the students need more information or not will allow the teacher to assess the step-by-step procedures of the activity.

Instructional Procedures:

1. As a class, discuss the differences between rocks and minerals. (Rocks are made of minerals. See background information.)
2. In their science journals, have each student describe the differences between minerals and rocks.
3. Assign the students into small groups of 3-4.
4. Take a field trip to Emigration Creek.
5. Have each group collect different rock samples. The collection should include at least one example of each of the three types of rocks; igneous, metamorphic, and sedimentary.
6. Instruct students to observe the rocks using a magnifying glass and/or field microscopes and draw the shapes and colors of the minerals in journal.
7. (Back in classroom), discuss the three different types of rocks. Identify each type of rock and describe its characteristics.
    - Sedimentary
        - Rounded-appearing mineral and rock particles that are cemented together
        - Often in layers
    - Igneous
        - With or without observable crystals
        - Not in layers
        - With or without air holes
        - Could be glass-like
    - Metamorphic
        - Crystals/minerals lined up (aligned)
        - Often in layers, sheet-like
8. Instruct students to sort rocks by appearance according to the three basic types: sedimentary, igneous and metamorphic. Examples of Utah rocks include the following:
    - Sedimentary: sandstone, conglomerate, shale
    - Igneous: basalt, granite, obsidian, pumice
    - Metamorphic: marble, gneiss, schist
9. Have each group classify their findings. Move among the groups answering questions but do not identify samples (give answers).
10. After 20 minutes, correct the groups' classifications as a class.
11. To conclude the lesson, have the students write what they observed at Emigration Creek only concerning sedimentary rocks. (They can draw and color if they wish.)

Discussion Questions:

1. What is the difference between rocks and minerals?
2. How are sedimentary rocks formed?
3. Name at least two types of sedimentary rocks.
4. What are the other types of rocks besides sedimentary?

Assessment Strategies:

The assessment approach will be continuous throughout the lesson. The students K-W-L chart will be a tool for the teacher to understand the individual student. Working in groups will allow collaboration assessment and how well they follow directions. The journals (lab notebook) can be turned in for a formal assessment of learning including: hypothesis, experiment, and conclusions.

Part of this lesson was from UEN:
http://www.uen.org/Lessonplan/preview.cgi?LPid=2492

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Emigration Creek Observation

Abstract:
The class will take a field trip to Emigration Creek and explore the environment and layering of the Emigration Creek wall. This lesson introduces the idea of sedimentary layering and how it applies in the student's environment. Students will explore how this creek wall formed and the different layers that formed.

Grade Level:
4th

Utah Core Curriculum Standards:
Standard 03
Students will understand the basic properties of rocks, the process involved in the formation of rocks, and the needs of plants provided by soil.
Objective 1
Students will observe certain properties of rocks.

Objective 2
Students will observe rock erosion.

Duration:
1 school day

Background Information:
Sedimentary layers form through a long period of time underneath the earth. Through this long period of time rock and gravel are moved a shifted by materials to form the layers of sedimentary. The heavier materials in sediment will settle at the bottom, while the new material will settle at the top. These sedimentary layers can be seen in our mountains and rocks.

Terminology:
- Weathering- erosion of rock
- Sedimentary Rock- grains of material taken from previous rocks
- Layering- when different materials are deposited on top of each other

Intended Learning Outcomes:
Students will observe, sketch, and classify the different layers in the Emigration Creek Wall.

Prior Knowledge Assessment:
The teacher will lead a class discussion reviewing how sedimentary layers form and where in our environment you may be able to find these layers. The teacher will write the students answers in a mind map on the board.

Materials:
Signed permission slips, volunteers, colored pencils, pencils, and science notebooks.

Procedure:
Before leaving the classroom, the class will discuss what they remember about sedimentary layers and brainstorm a list on the board of where they might find sedimentary layers in their environments. Student will then leave to Emigration Creek.
When students arrive, the teacher will give directions to the students. Each student will need a partner and will sketch the rock wall and observe its colors and characteristics. The partners will then come up with one question to present to the class about Emigration Creek's wall.

Closure:
When students arrive back at the classroom, the class will talk about what they observed. The teacher will write down the student's observations and create a list on the board. Students will present their questions and discuss each question as a class.

Assessment:
Students' sketches in their notebooks will show the different layers of sedimentary rocks.
Students will verbalize their observations of Emigration Creek Wall as partners and as a class.
Students will use questioning to explore even more about EmigraNicole McCrea

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The Rock Face at Emigration Creek: How did it get that way?

Abstract:

This lesson is designed to have students study Emigration Creek particularly the rock face on the Westminster College campus. Student will observe the rock face and study the sediment it contains. This lesson simulates the process in which the emigration rock wall formed as a result of the variable flow of water.

Utah Elementary Core Curriculum Standards

Standard 3

Science Benchmark
Earth materials include rocks, soils, water, and gases. Rock is composed of minerals. Earth materials change over time from one form to another. These changes require energy. Erosion is the movement of materials and weathering is the breakage of bedrock and larger rocks into smaller rocks and soil materials. Soil is continually being formed from weathered rock and plant remains. Soil contains many living organisms. Plants generally get water and minerals from soil.

Students will understand the basic properties of rocks, the processes involved in the formation of soils, and the needs of plants provided by soil.

Objective 1
Identify basic properties of minerals and rocks.

a. Describe the differences between minerals and rocks.
b. Observe rocks using a magnifying glass and draw shapes and colors of the minerals.
c. Sort rocks by appearance according to the three basic types: sedimentary, igneous and metamorphic (e.g., sedimentary–rounded-appearing mineral and rock particles that are cemented together, often in layers; igneous–with or without observable crystals that are not in layers or with or without air holes or glasslike; metamorphic –crystals/minerals, often in layers).
d. Classify common rocks found in Utah as sedimentary (i.e., sandstone, conglomerate, shale), igneous (i.e., basalt, granite, obsidian, pumice) and metamorphic (i.e., marble, gneiss, schist).

Objective 2
Explain how the processes of weathering and erosion change and move materials that become soil.

a. Identify the processes of physical weathering that break down rocks at Earth's surface (i.e., water movement, freezing, plant growth, wind).
b. Distinguish between weathering (i.e., wearing down and breaking of rock surfaces) and erosion (i.e., the movement of materials).
c. Model erosion of Earth materials and collection of these materials as part of the process that leads to soil (e.g., water moving sand in a playground area and depositing this sand in another area).
d. Investigate layers of soil in the local area and predict the sources of the sand and rocks in the soil.

In class instructional time: 2 – hour and a half periods

Terminalogy

Sediment- Bits of rock and sand combined together

Rate of water flow- The speed at which the water flows in a particular direction

Intended learning outcomes

- Students will identify and demonstrate how the sediments in the rock wall at Emigration Creek formed
- Students will be able to describe why the rock wall formed the way it did
- Students will identify the different sediments in the rock wall

Background information

1. Students complete lesson one of this unit visit/ sketch the rock wall at Emigration Creek.
2. **Sedimentary Rocks:** When mountains first form, they are tall and jagged like the Rocky Mountains on the west coast of North America. Over millions of years the mountains become old mountains like the Appalachian Mountains on the east coast of the United States. We can tell when mountains are old noticing the jagged edged are now rounded and much lower. What happens over the millions of years that causes the mountains to old? Well the rock gets worn away due to erosion which is caused by rain, the freeze/thaw cycle, and wind and running water. All these different weather element cause the mountains to wear and crumble over time

The streams & rivers that flow down from the mountains carry the pieces of small rock down with them. These little bits of rock & sand are called sediments. When the flow of the water slows down, these sediments settle to the bottom of the lake or oceans they run into. Over many years, layers of different rock bits settle at the bottom of lakes and oceans.

When layers and layers of sediment have accumulated, the weight squishes all the sediments together. Over time the layers of sand and mud turn into rocks because of the pressure. These are called Sedimentary rocks.

Some examples of sedimentary rocks are sandstone, shale, marble and jasper.

Sedimentary rocks have fossils in them because plants & animals that have died get covered up by new layers of sediment and are turned into stone. Most of the fossils we find are of plants & animals that lived in the sea.

When there are large amounts of plants in sedimentary rocks, they turn into carbon (over a long period of time), which gives us our coal, oil, natural gas and petroleum.

- Sedimentary rocks cover 75% of the earth's surface. Most of the rocks found on the Earth's surface are sedimentary. Sedimentary rocks make up less than 5% of all the rocks that make up Earth.
- When rocks are exposed to the elements – air, rain, sun, freeze/thaw cycle, plants – erosion occurs and the little bits of rock worn away get deposited as sediments. Over time, these sediments harden as they get buried by more sediments and turn into sedimentary rocks from the pressure
- Sedimentary rocks are usually formed in layers (strata).

There are 6 main kinds of sedimentary rocks that have been identified by the way they look

1. Conglomerate rock has rounded rocks (pebbles, boulders) cemented together
2. Sandstone is a soft stone that is made when sand grains cement together. Sometimes the sandstone is deposited in layers of different colored sand.
3. Shale is clay that has been hardened and turned into rock. It often breaks apart in large flat sections.
4. Limestone is a rock that contains many fossils and is made of calcium carbonate &/or microscopic shells.
5. Gypsum, common salt or Epsom salt is found where sea water precipitates the salt as the water evaporates.
6. Porphory rock is when jagged bits of rock are cemented together

Information from www.rocksforkids.com

Materials:

- Glass Aquarium
- Mixture of dirt, pebbles and small rocks collected from Emigration Creek (represents sediment in rock wall)
- Hose
- Variable water source
- Books or box for elevating one end of the aquarium
- Science observation notebook
- Second timer
- Trowels/ one for each group
- Buckets/ one for each group

Assessment of prior knowledge:

1. Have some of the students come up and share their sketches from their previous visit to the rock face at Emigration Creek
2. Create a list of the different things that the class observed about the rock face
3. Point out the large rocks at the bottom of the rock wall and ask the students how they think the rocks got there. Make a list of the possible answers

Instructional procedures:

1. Divide the students into groups of 5
2. With the students travel to Emigration Creek and gave each of the groups collect various sediments from Emigration Creek. Talk first about what sediments are. Define it
3. Return to the classroom with the sediments
4. Set up an aquarium angling at approximately a 45 degree angle using a box or several books.
5. Discuss the experiment with the students and have them draw a hypothesis about how the sediments will be affected by the flowing water at variable stages.
6. Place the collected sediments at the higher end of the aquarium
7. Place hose at the top of the slope. Talk about what the rate of the flow of water is.
8. Turn on water source to the #1 slowest rate of water flow for ten seconds.
9. Change water to #2 slow flow for ten seconds
10. Change water to #3 medium flow for ten seconds
11. Change water to #4 Fast flow for ten seconds
12. Turn off the water source

13. Let aquarium sit undisturbed for about 3 hours or until the sediments in the water have cleared (or until the next science period, the next day)
14. Make observations about the rock and sediment placing inside the aquarium
15. Each group should record/ sketch their results in their individual science observation journals.
16. Drain water and strain sediments and repeat process if necessary.
17. Have the students write their conclusions about the experiment in their observation journals

Discussion questions:

- How does what has been created in the aquarium resemble the face of the rock wall?
- How did the rate of the flowing water affect the structure of the rock wall?
- Did the experiment prove your hypothesis, why or why not?

Assessment strategies

1. Teacher will collect the students' observation journals. The teacher will look at the following areas for understanding:
    - Sketches of the process
    - Clearly stated hypothesis with conclusion either discrediting or proving their own hypothesis
    - Clear understanding of the discussion questions
2. Observations of the students during the experimentation process
    - Hands on participation
    - Offers ideas and accepts other ideas