1. Geology Rocks!
(2) Scratching the Surface

*The **rocks** and **minerals** found in this part of the Pecos River Valley tell the geologic story. (Field Trip or Classroom / 30-45 minutes)*

Connecting with Science Standards			
Category/Strand	***Grade***	***Standard(s)***	***Benchmark(s)***
Scientific Thinking/Practice	4	Methods	Observation & interpretation
	5		Investigations
Earth & Space Science	4	Structure of earth	Rock cycle processes
	5		Water/air – earth processes

Goal: By learning to identify different rocks and minerals, students will better understand the processes that formed the geologic features Bottomless Lakes State Park.

Objective:

- Understand the difference between rocks and minerals
- Perform scratch tests
- Identify the different rocks and minerals in the park and explain how they were formed
- Learn the differences between **sedimentary, igneous** and **metamorphic** rocks

Materials:

- Collection of local rocks and minerals, including siltstone, **halite,** gypsum, **slate** and **quartz** (Pecos diamonds)
- Pennies, paper clips, nails and glass baby food jars
- Hand lenses
- Mohs hardness scale
- Rating sheet
- Pens/pencils

Background

All **rocks** and **minerals** have stories. These time machines tell us where they've been, what they're made of and what was happening at the time they were formed. Many have changed over time, and their stories show us how the earth has changed. By learning to read rocks and minerals, students can better understand the geologic forces that have shaped Bottomless Lakes and how **geology** influences who lives here.

Procedure I: Sorting Rocks

1. Have students work in teams of 3-4.

2. Give each team a set of rocks and minerals, including those found at Bottomless Lakes State Park/Bitter Lake Wildlife Refuge.

3. Discuss the differences between rocks and minerals (i.e., rocks are made of minerals, minerals are the building blocks of rocks) or (think of rocks as cookies made of several ingredients, and minerals are like the ingredients, (chocolate chips, sugar, nuts, etc.)

4. Students sort their collection into rocks and minerals.

5. Teams examine their "rock group", answering questions on the Rock Observation Worksheet and identifying which rocks are sedimentary, igneous and metamorphic.

Procedure II: Sorting Minerals

1. Teams examine their minerals with a hand lens, noting their texture, color and luster (shininess). Findings are recorded on rating sheet.

2. Students test minerals with the Mohs hardness scale scratch test, (included in this guide) using their fingernails, pennies, paper clips, nails and the glass jar.

3. Students write their results on the rating sheet, identify the minerals and rank them from hardest to softest.

4. Have teams share their results.

5. Discuss how these minerals were formed at Bottomless Lakes/Bitter Lake and their roles in the geologic story.

GEOLOGY ROCKS!

Sorting Out the Differences Between Rocks and Minerals

What is a rock?

We all know what rocks are right? They lie on the ground practically everywhere you look. They are mountains, canyons, you throw them, you sit on them, and you dig them out of your garden. However, here is a more exact definition.
A rock is:

- a solid
- naturally occurring
- is made up of minerals or mineral-like matter.

Rock Composition

Some rocks are composed of just one mineral. Pyrite and **quartz** are two common rocks that fit this category. Most rocks are a solid mixture of several minerals, like granite.

Rock Classification

Rocks are classified by how they are formed. There are three basic groups, **igneous, sedimentary,** and **metamorphic**.

What is a mineral?

Pecos diamonds (Quartz) from New Mexico Bureau of Geology and Mineral Resources Photograph from Virgil Lueth

A **mineral:**

- is naturally occurring
- is a solid
- is inorganic (not biological)
- has a fixed chemical formula
- has an orderly crystalline structure

There are about 4000 known minerals on earth. Each one is a unique substance with its own chemical formula. Most of these are very rare.

There are only eight groups of minerals that are common. They are called **rock-forming minerals**. They are:

Native elements	**Sulfides**	**Oxides**
Nitrates	**Phosphates**	**Sulfates**
Halides	**Silicates**	

Sources: New Mexico Bureau of Geology and Mineral Resources – www.geoinfo.nmt.edu

GEOLOGY ROCKS/Rocks and Minerals
Vocabulary

Geology: the study of the structure of the earth, especially its rocks, minerals and soils, and its history and origin. (Greek – *Geo* = earth, *logos* = speech)

Halite: the mineral form of sodium chloride, commonly known as rock salt.

Igneous: rock formed from molten magma.

Metamorphic: rocks formed from older rocks by great heat and pressure or chemical changes.

Mineral: a naturally occurring substance with a characteristic chemical composition and usually with typical color, texture and crystal form.

Quartz (Pecos Diamonds): a hard, glassy, rock-forming mineral composed of crystalline silica. Locally known "Pecos diamonds" are small quartz crystals found in gypsum outcrops.

Rock: a naturally occurring aggregate of minerals. Rocks are classified by mineral and chemical composition, by the texture of the constituent particles and by the processes that formed them.

Sedimentary: rock formed from other particles of rock transported and deposited by wind, water, or ice. Rock formed from sediments covers 75-80% of the Earth's land area, and includes common types such as limestone, chalk, siltstone, sandstone, conglomerate, and shale.

Slate: a fine-grained metamorphic rock, derived from shale, which breaks into thin, smooth-surfaced layers.

Definitions from Wikipedia.com, Geology.com, and Roadside Geology of New Mexico *(Chronic, 1987)*

GEOLOGY ROCKS/ Rocks and Minerals
Teacher Evaluation

Your feedback will help make the Outdoor Classroom Program a long-lived success. Please help us improve this activity and the BWBL curriculum by taking a few minutes to provide some constructive answers to the questions below.

Date of field trip:_____ Location of field trip: _____

School/City: _____ Grade: _____ # students: _____

Your name: _____ Your phone or email: _____

1. In what capacity did you use this activity? (please check one) ____ field trip _____ classroom (pre- or post-field trip)
2. Who led the activity? (please check one) ____you _____another teacher _____agency staff
3. Please rate your overall impression of this activity.

1 2 3 4 5 6 7 8 9 10 (please circle one)
Poor Good Excellent

4. How well do you think it met the stated Goals/Objectives on the front page of the activity?

1 2 3 4 5 6 7 8 9 10 (please circle one)
Poorly Fairly well Right on target

5. How well did it compliment/support classroom study?

1 2 3 4 5 6 7 8 9 10 (please circle one)
Poorly Fairly well Right on target

E1. What do you believe your students gained from this activity in terms of learning?

E2. How did you assess learning from this activity?

E3. What would you suggest as a practical assessment for future revisions of this activity?

E4. What else would you suggest to improve this activity and/or the BWBL curriculum?

Please fax this completed form to (505) 476-3361, Attn: Outdoor Classroom Program

Geology Rocks!
Mineral Hardness Rating Sheet

Team/Name: _____ Date: _____

Put an X in each box where the object can scratch the mineral or be scratched by the mineral:

Mineral #	Fingernail 	Penny 	Paper Clip 	Butter Knife 	Nail 	Glass Jar 
Mineral 1						
Mineral 2						
Mineral 3						
Mineral 4						

Rank your mineral with the following numbers, based on how they can be scratched:

Can be scratched with a fingernail	2
Can be scratched with a penny	3
Can be easily scratched with a paper clip	4
Can be scratched with a butter knife	5
Can be scratched with a nail	6
Can easily scratch glass	7

Write the four minerals in order of hardness, from hardest to softest:

1. _____

2. _____

3. _____

4. _____