

# **“Karst Rock Detective: Identifying Ozark Rocks” Lesson Plan**

By Mary Ann Mutrux, Willow Springs Middle School

## **Lesson Summary:**

For this lesson, students will be asked to bring an Ozark rock from home or nearby. They will conduct common rocks tests to identify the rocks. A simple rock lab chart will be used to identify four common Ozark rocks: limestone, dolomite, chert and sandstone. Most likely, student will bring in a chert rock. The limestone and dolomite are water soluble and therefore are generally below the surface; the insoluble chert remains at the surface. Students will graph the lab results and most likely realize that the limestone and dolomite rocks at the surface have disappeared because they are water soluble, and the water-resistant chert remains at the surface.

This curriculum was written to accompany the educational video “*Karst in the Ozarks*.” Students should watch the video before beginning the lesson. It is available online at <http://www.watersheds.org>.

Note: This lesson is recommended only for schools located in the Ozarks.

## **Missouri Show Me Standards:**

### ***Process Standard: 1.3***

Students will demonstrate within and integrate across all content areas the ability to design and conduct field and laboratory investigation to study nature and society.

### ***Science Contents Standards – Strand 5 Earth Systems:***

SC5.1A4b (physical properties of rocks)

SC5.2A4c (chemical weathering)

SC1.1G6abc (chemical & physical changes)

SC5.1B6a (water acting as a solvent)

SC5.1A8abc (rock & mineral identification)

## **Essential Vocabulary:**

Sedimentary rock	Chemical change
Sediments	Limestone
Minerals	Dolomite
Calcite	Sandstone
Acid	Chert / Nodules
Weathering	Silicate

### **Related Web Links / Background Information:**

<http://www.dnr.mo.gov/geology/docs/gcwinter6.pdf> [MDNR –Limestone]

<http://dnr.mo.gov/pubs/pub661.pdf> [Missouri Department of Natural Resources – Chert Fact Sheet]

<http://dnr.mo.gov/geology/adm/publications/map-ShdRelief.pdf> [MDNR – Regions in Missouri MAP]

<http://dnr.mo.gov/geology/adm/publications/map-GenGeoMap.pdf> [MDNR – Geological Map of Missouri]

<http://dnr.mo.gov/pubs/pub655.pdf> [MDNR - Missouri Ozarks Fact Sheet]

<http://dnr.mo.gov/pubs/pub653.pdf> [MDNR – Mozarkite Fact Sheet]

<http://www.watersheds.org/earth/types.htm> [watersheds.org – rocks]

<http://dese.mo.gov/divimprove/curriculum/science/IntermPE11.05.pdf> [DESE intermediate Performance Event Template for bar graphs]

### **Required Materials:**

#### **Lab:**

- Assorted Ozark rocks collected by students (this lesson is limited to schools located in the Ozarks)
- Weak Acid in drop bottle (5% hydrochloric acid – see high school chemistry teacher for solution)
- *Ozark Rock Chart* copies (one per student)
- Hand lens (one per student)
- Goggles (one pair per student, if students are allowed to do the acid test)
- Iron Nails (one per student)
- Water sink access / Paper Towels
- Thick Glass Plates (for mineral hardness test, see a geology supply catalog)

#### **Visuals:**

- Overhead transparency of the sedimentary rock formation or projected Internet image
- Missouri maps (see related web links above)

#### **Optional Materials:**

- Rock Samples: Limestone / Dolomite / Sandstone / Chert
- Rock hammer: Utilize to break rock open to observe fresh face of rock instead of weathered exterior.
- Copies of the MDNR Fact Sheet: Chert and / or Missouri Ozarks

### **Safety Considerations:**

- Depending on student ages, general level of lab experience, and the availability of goggles, the teacher needs to decide who will apply the weak acid drops on the rock samples (teacher or students).
- If possible (not necessary), break the rock open with a rock hammer to expose a fresh face. Observations and tests are easier to conduct on an exposed interior of the rock. For middle school children, the teacher should break the rocks and anyone in the area must be wearing goggles. **This must be done outdoors, so tile or flooring is not damaged.**
- Goggles should be worn when placing a drop of weak acid on the rock samples.
- Students should not touch the rocks where acid has been applied.
- All rocks that have had acid placed on them need to be washed immediately by the teacher.
- If students touch the acid, they need to wash their hands immediately.
- If glass plates are used for a hardness test, then they will need to be kept flat on the table surface when performing the test.
- All rock samples should be rinsed with water thoroughly after the lab.

### **Time Requirements:**

#### *Preparation Time:*

- Preparation time will vary according to the availability of the lab supplies.
- Students will have to be given direction and the opportunity to gather a rock from their home, park or nearby area in the Ozarks before conducting the activity.

#### *Activity Time:*

- Activity time will depend on the number of samples being tested. Instruct students to get a rock sample from the sides of Ozark hills, rocky outcrops along roads (with adult supervision) or along creeks and streams.

### **Lesson Warm Up:**

- Have students get out their rocks and examine them. Then have them look at each other's and make general comparisons. Ask them to determine if they think any of them have the same kind. Ask for students to support their reasoning.
- Tell students that they are going to use several tests and a rock lab chart to determine what type of rock they may have. Explain they will be testing both a physical property (hardness – scratched) and chemical property (acid test).
- Explain that the limestone and dolomite will bubble or effervesce in the weak acid. This is how karst features such as caves and sinkholes form. However, rainwater is the weak acid. Rainwater becomes a weak acid when

it picks up the gas carbon dioxide from decaying vegetation on its way into the ground. The rainwater like the acid is a “solvent,” because it dissolves.

- Explain that they are like detectives and are using tests to narrow down the unknown rock. Explain that if their rock cannot be identified with the key, then it may not be one of those rocks. In that case they may have a mineral or another Missouri rock.
- Have students predict which of the four rock types will make up most of the samples collected by the class.

### **Karst Rock Detective Activity:**

- Pass out the *Ozark Rock Lab* chart and step sheet. Go through the handout and explain how to conduct each test (see safety considerations above). *Note: the chart is required, but the step sheet is optional.*
- Take a rock (one that you have previously identified as one on the flow chart) and demonstrate the process of identifying the rock using the flow chart and tests. If possible, do this for each of the four rocks on the chart.
- Tell students that they will be doing the same thing. Have students work in small groups together and assist each and verify each other’s observations.
- Check students for accuracy when they have completed their tests.
- Emphasize that a chemical change is taking place when the acid test produces bubbles and a physical change is taking place if the rock is scratched.
- Have the students group the rocks together that are the same time and discuss other differences or similarities that they may observe.
- Student could read the handout about chert after they conduct the activity and are waiting for others to finish.

### **Lesson Wrap Up:**

- Have students construct a bar graph for the number of Ozark rocks identified. Make a bar for the unknown rocks that could not be identified by the key. For bar graph construction see the performance event template for immediate science at the DESE website (stated above).
- Explain that when the limestone bubbled on contact and the dolomite bubbled when in powder form, the rock was dissolving. Rainwater that soaks through the ground acts like a weak acid and dissolves these two rocks. As a result, cavities in rocks such as caves and sinkholes form. This is a chemical change taking place.
- Remind students that the rocks under their feet in the Ozarks are mainly layers of limestone and dolomite that dissolve by rain water, creating karst features over millions of years. The chert and sandstone are other rocks that formed along with them, but they are not soluble in water. (In the pilot for this lesson 76% of the rocks students brought in were chert. Students realized that the chert which is insoluble is what is left at the surface of the Ozarks. The rocks which are soluble in water have “disappeared” as they have dissolved in water and are further under the ground.)

### **Modifications:**

*The lesson difficulty could be decreased by making the following adaptations:*

- Provide students with rock samples that were previously identified.
- Take students to a location to collect rocks (quarry, outcrop).

*The lesson difficulty could be increased by making the following additions:*

- Provide students with the chemical formula for the weak acid reaction.
- Have other rock and mineral identification guides available for students to use with rock specimens that are not on the flow chart.

### **Assessments:**

To assess the students learning, have them answer one or both of the following questions.

- Construct a table of four common Missouri sedimentary rocks. Include their name, grain or crystal composition, and identifying tests.
- Have students write a paragraph explaining how limestone and dolomite can be identified.