GREAT LAKES LEARNING

LESSONS & ACTIVITIES BASED ON THE MONTHLY GREAT LAKES NOW PROGRAM

EPISODE 2308 | ROCKHOUNDING

SHORELINE STONES

OVERVIEW

This lesson will explore the phenomenon of **erosion**, as students learn about the diversity of rocks present in the Great Lakes. They will explore the geology of the region and the outdoor adventure that make rock hunting in this area special, as well as conduct a variety of experiments to better understand rock formation and classification in the Great Lakes.

LESSON OBJECTIVES

- **Know** the difference between weathering and erosion
- **Understand** what makes rockhounding in the Great Lakes unique
- **Be able to** conduct experiments to test and evaluate different rock samples

WHAT YOU'LL NEED

- Computer or mobile device with Internet access to view video and online resources
- Notebooks and pencils
- Chart paper
- Sticky notes
- Markers
- Lab supplies (see individual activities for a full list)
- Copies of the Student Handouts

INTRODUCTION

Rock hunting is a science aficionado's dream in the Great Lakes region. From the diversity of geological formations to the rich history of glacial activity, and from the fossils, gemstones, educational opportunities to the scenic beauty, and outdoor adventure, rockhounding in the Great Lakes is a one of a kind experience. To better appreciate what makes Great Lakes geology special, you have to understand why the area has the rocks and minerals it does, how they got there, and what's present in the region. They'll conduct several experiments, do a one-of-a-kind research project, and use their learning to understand the rocks and minerals in their own communities. Whether you're a geology enthusiast, a history buff, or simply seeking a rewarding and educational outdoor activity, rock hunting in the Great Lakes region can offer a fulfilling experience.

This lesson includes multiple activities, including lab activities, that can span the course of several sessions or be adapted to fit the needs of your group's meeting format.

Some prior knowledge* with which students should be familiar includes:

- the three basic types of rocks
- the water cycle
- states of matter
- properties of matter
- chemical and physical change

Follow this QR Code or hyperlink to the Episode Landing Page!

Check out our full collection of lessons for more activities related to topics like these.

****The sequence of these activities is flexible, and can be rearranged to fit your teaching needs.***

NGSS CONNECTIONS

Phenomenon: Erosion

- 5-ESS3-1
- MS-ESS2-1
- MS-ESS2-2
- MS-ESS2-3
- SEP 2
- SEP 3
- SEP 4
- SEP 6
- SEP 7
- SEP 8

During the course of the lesson, students will progress through the following sequence** of activities:

- Class discussion to elicit and activate prior knowledge about **erosion** and weathering
- Teacher notes on **rocks and minerals** in the Great Lakes
- Watch a segment from *Great Lakes Now*
- Class discussion to debrief the video
- Experiment with different tests to analyze and classify rock composition
- Conduct a research project that involves rock hunting in local communities
- Read about **mineral use in winter**

The lesson progresses through three major sections: **launch, activities, and closure.** After the launch of the lesson, you are ready to begin the lesson activities. Once finished with the activities, students will synthesize their learning in the closure. You can select the activities that are best suited for your learners and teaching goals, and then sequence them in a way that makes sense within your learning progression and the scaffolds of the lesson.

If you use this lesson or any of its activities with your learners, we'd love to hear about it!

Contact us with any feedback or questions at:
GreatLakesNow@DPTV.org

LESSON LAUNCH

A. Warm Up

The warm up is intended to be structured as teacher-facilitated, whole-group student discussion activities. It helps students to begin thinking about the topic at the center of the lesson.

1. Ask students to list out on a piece of paper five things that come to mind when thinking of **erosion**.
2. Have students pair up with a partner to share their five ideas with each other. If any ideas appear on both lists, have students circle those.
3. Then, engage students in a whole-group discussion to ask them to share any ideas that were circled.
4. Generate a list of the circled ideas.
5. Ask for volunteers to share any ideas that were not circled that they think are really important to include in this topic.
6. Generate a separate list of those ideas.
7. At the end of making the two lists, have students copy down one single list of all the circled ideas and important ideas in their notebooks or on their paper.
8. Ask students individually to rank the ideas in the list from most to least relevant.
9. Ask for some students to share which term should be most relevant and why they think that is. Engage the whole group in discussion to arrive at consensus about the most relevant idea related to **erosion** that they already know about or that came to mind during this exercise.

B. Bridge to Learning

Activate prior knowledge and get students thinking about the differences between weathering and erosion by having them research each term and create a venn diagram that compares and connects the two.

C. Close Reading a Photo

Show the **this image of Pictured Rocks** to students either by displaying it on a centralized display or making the image available to students individually. Ask them to discuss how they think the Pictured Rocks got to be the way they are and be sure to have them back up their claim using reasoning based on evidence from the photo itself.

D. Categorize Rocks

Gather an assortment of rocks of different colors, sizes, shapes, and textures. Arrange students into groups of four and then provide each group with about a dozen different rocks. Give students the challenge of sorting these rocks into groups. They can have as many or as few groups as they want with any number of members in each group. The only thing that's required is that they provide a rationale for why they grouped their rocks the way that they did.

They should create a poster to make their thinking visible as to how they categorized. When done, have the whole group discuss their different methods of sorting and grouping the rocks. Help them to focus on what properties they each considered and whether there were some commonalities between what all the groups considered. Emphasize that categorizing rocks is based on whatever grouping system is developed and adopted by scientists to use.

E. Background Information Notes

Explain that we are about to learn more about rocks and erosion. Then, give the **Teacher Background Notes** to students.

TEACHER BACKGROUND INFORMATION

by Gary G. Abud, Jr., Great Lakes Now Contributor

**This information can be presented by the teacher as notes to students at the teacher's discretion.*

Minerals are naturally occurring substances, which, in general, are inorganic (e.g., don't contain the element carbon), yet they play crucial roles in various geological and biological processes. There are over 5,000 minerals, and only 8% contain carbon. One of the most common minerals is sodium chloride, or table salt. Some minerals, called **gemstones**, are valued for their beauty, and some, like diamond, contain carbon. **Rocks**, in turn, are solid substances made up of one or more minerals. As well, most rocks are inorganic, but some, like coal, contain carbon.

Because minerals are the building blocks of rocks, rocks are essentially a solid mixture of different minerals all stuck together. Think of it like baking a cake: the cake itself is like a rock, and the ingredients you use to make the cake—flour, sugar, and eggs—are like the minerals that make up the rock.

Rocks and minerals have specific properties to their appearance and make up—including their chemical composition, color, luster, hardness, density, and even how they break—that are used to test, analyze, and classify them.

Scientists test various regions of the earth's surface—known as the earth's crust—for what rocks and minerals are present. They can learn a lot about the composition and history of a region just by what rocks are present. But you don't have to be a scientist to be interested in rocks. Some people collect, or "hunt" for, rocks—a recreational activity known as **rockhounding** in which individuals explore natural environments in search of interesting and unique rocks, minerals, gemstones, and even sometimes fossils.

Rock hunting is an enjoyable outdoor pastime for individuals and families to search for hidden geological treasures, engage in educational opportunities to learn about Earth's history, and enjoy the scenic beauty of the natural landscapes such as beaches, shorelines, and rock formations.

The Great Lakes make for a particularly special location for rock hunting due to its rich history and varied landscapes.

The Great Lakes region has a diverse geological history that spans billions of years, resulting in a wide variety of rock types and formations. From the ancient Precambrian rocks of the Canadian Shield to the glacial deposits and sedimentary rocks left behind by retreating ice sheets, there's a wealth of geological treasures to explore.

That very glacial activity from the last ice age had a significant impact on the Great Lakes region's rocks and mineral deposits. Glaciers carved out the landscape of the Great Lakes itself, leaving behind not only the five basins of Huron, Ontario, Michigan, Erie, and Superior, but unique rock formations, as well. Those same glaciers transported rocks and minerals from other regions of the continent to the Great Lakes. These glacial deposits mean you can find rocks and minerals that are not native to the Great Lakes.

The Great Lakes region also holds a rich fossil record, including remnants of ancient marine life from when the area was covered by ancient seas. Fossil enthusiasts can discover various marine fossils, such as trilobites, which provide insights into the region's past environments and ecosystems. Among the most renowned Great Lakes fossils is the **Petoskey stone**, found in Michigan near Lake Michigan's shores. As the state stone of Michigan, it carries cultural and geological significance. These stones are actually fossilized coral cross-sections from seas that existed around 350 million years ago, characterized by their smooth texture and distinctive hexagonal pattern due to erosion.

Weathering is the gradual breakdown of rocks and minerals into smaller pieces due to the effects of various environmental factors, such as the weather. **Erosion**, on the other hand, is the process by which small pieces of rocks or minerals are transported away from their original location and deposited in different areas. by flowing water, wind, or ice.

ACTIVITY 1: WATCH A GREAT LAKES NOW SEGMENT

This activity is a video discussion of a *Great Lakes Now* episode segment.

First, inform students that they will be watching a *Great Lakes Now* segment about what rock hunters have found in the Great Lakes region. During the video they need to jot down four things they took away from the video using the **4 Notes Summary Protocol**.

Then, if students are not already familiar, introduce them to the 4 Notes Summary Protocol, which they will use after they finish watching the video, where they write down one of each of the following notes:

- **Oooh!** (something that was interesting)
- **Aaah!** (something that was an ah-ha moment)
- **Hmmm…** (something that left them wanting to know more)
- **Huh?** (a question they have afterward)

Next, have students watch the segment from **episode 2308** of *Great Lakes Now* called **Finding Treasure on Great Lakes Beaches**. The first part of the segment looks at the shipwreck tours.

Last, have students complete their individual 4 Notes Summary and then discuss those in groups of 3-4 students.

Teaching Tip: Use the Student Handouts to help students organize their thinking in writing around each of the lesson protocols.

Post-Video Discussion

After the groups have had time to go over their 4 Notes Summaries, invite a handful of students to share out some of their notes, eliciting at least 1-2 of each of the 4 Notes and listing those somewhere for the whole group to see.

Ask students to turn back and talk with their groups to make connections between the *Great Lakes Now* video and what they remember from the warm-up activities.

How is what we saw in the video related to what we discussed earlier during the lesson launch activities?

After giving the groups some time to talk, bring the whole group back together for a shareout and discussion of ideas.

In this culminating discussion, the goal is to help students make connections between the video segment and what they discussed during the launch activities earlier in the lesson about what they knew about **erosion.**

Once the discussion finishes, have each student write a "**Sum It Up**" statement in their notebooks. This is a single sentence that captures the big idea of what was just learned.

Have 2-3 students share out their **Sum It Up** statements before concluding this activity.

ACTIVITY 2: READ ABOUT THE MINERAL ROAD SALT

In this activity, students will read about how researchers are looking at vegetables and juices for alternatives to road salt to combat icy road conditions in the Great Lakes winters. In part, road salt causes damage and deterioration to roads, but it also poses concerns for the environment. And that's why scientists are seeking to find alternative ways to de-ice the roads.

In this activity, students will use a **Think Pair Square Protocol** for discussing what they will read about this very topic.

First, have students partner up and distribute the article **Road Salt** by Kathy Johnson from *Great Lakes Now*. Allow time for students to individually read the article, and have them jot down three things they took away from the article using the **Rose Thorn Bud Protocol**—in their notebook or using the handout.

Then, give students time after reading to discuss the article that they read with their partner. Have students share their rose, thorn, and bud with each other, including how those points connect to each other. The pair should come up with a statement to summarize all of their article takeaways.

Next, have two student pairs join up, standing near each other to form the four corners of a square, to discuss the article and what they talked about in their pairs. Encourage them to come to a consensus about which point they found most important or interesting in the article.

Last, have each group craft a summary statement of the most important point from their discussion and ask for a volunteer in each group to share that key point with the whole group. As student groups share their most important point, record their ideas on the board and have students copy the list of student ideas down into their notebooks. Once the shareout is complete, ask students to return to their groups and discuss one last question based on the article:

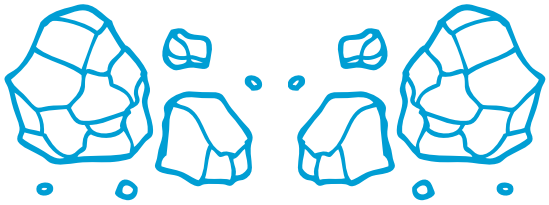
How should we balance the benefits and consequences of using the mineral road salt versus alternatives for de-icing the roads in winter?

You can keep this as a class discussion based on the article itself, or this can be extended into a writing assignment, presentation project, or further research on the topic to allow students to engage more deeply with the issue.

Teaching Tip:
If the reading level of the article is going to be tough for some students to read individually, have partners or small groups read the article together aloud while each follows along.

ACTIVITY 3: TESTING ROCK PROPERTIES

The purpose of this activity is to test the properties of various rocks in order to compare and classify them.



Materials

- A variety of rock samples of different color, size, shape, luster, texture, density
- Beakers (large enough to fit each rock)
- Water
- A ruler
- An electronic balance
- Large nails or paperclips
- Mohs scale of mineral hardness chart (optional)
- Vinegar
- Notebook or loose leaf paper

First, inform students that they will be working with a partner to investigate the properties of various rocks in order to categorize and compare them. Have students meet up with their partner and gather all their materials at their workspace.

Next, explain that they will be doing several tests, including hardness, density, and the acid test. They will need a way to keep track of all the data they're going to collect and keep everything organized for the results of all their rock samples. You might give them time to devise a way to record their data in each pair or have a whole class discussion to arrive at some consensus about how to keep track of all the data. It's important to emphasize that there could be multiple ways of organizing the data, but the key thing is that you can keep everything straight.

Then, give students time to perform each test on all their rock samples and to record their results for each test.

Last, have groups summarize and discuss their findings in a poster presentation.

Density Test Procedure

1. Measure the mass (in grams) of each rock sample
2. Determine the volume (in mL) of each rock sample by water displacement in the beaker by measuring the difference in volume of water before and after the rock is placed in the beaker
3. Calculate the density (in g/mL) of each rock using the measured values above

Hardness Test Procedure

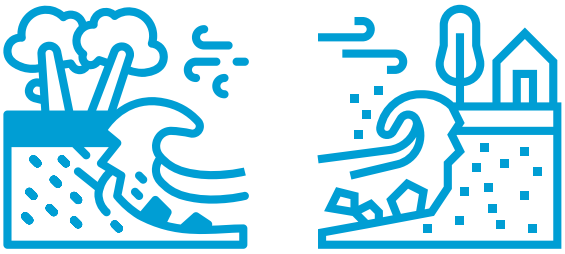
- Take a nail or paperclip and try to scratch the surface of each rock
- Observe the results as to whether there is a scratch on the rock or not
- Rocks that get scratched by the nail/paperclip are softer than the metal of the nail/paperclip, while those that resist scratching are harder.
- Record your results as harder/softer than the nail/paperclip
- Similarly, you can take one rock and try to scratch another rock with it. The same relative hardness principle applies: if one object can scratch the other, it is harder; if it cannot, it is softer
- Rank your rocks in terms of hardness

Carbonate Test Procedure

- Place a small amount of vinegar on the surface of each rock
- Observe any fizzing or bubbling and record the result

Note: Carbonate minerals (like calcite) will react with the acid, producing carbon dioxide gas, which causes the fizzing. No fizzing, no carbonate. This test is specific to detecting the presence of carbonate minerals in a rock sample.

ACTIVITY 4: SIMULATE EROSION



The purpose of this activity is for students to conduct an erosion simulation experiment, which will introduce them to the basic processes of erosion and sedimentation, to model how natural forces shape landscapes.

Materials:

- Various rocks (can be collected beforehand or provided by the teacher)
- Sand or soil
- Small pebbles
- Clay or modeling dough
- Disposable aluminum baking trays
- Water
- plastic water pitchers
- Plastic spoons or sticks for stirring
- Chart paper and markers

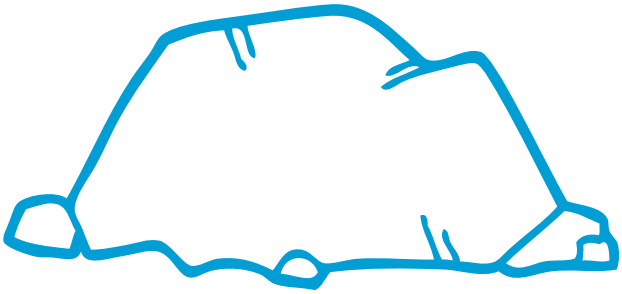
First, inform students that they will be modeling the natural processes of erosion and sedimentation. Review that **erosion** is when wind, water, or ice move dirt and rocks from one place to another, like when a river carries away soil from a riverbank. **Sedimentation** happens when the moved dirt and rocks settle down in a new spot, such as when sand gathers at the bottom of a pond. So, erosion moves things, and sedimentation is when those things find a new home. Use visuals, such as diagrams or pictures, to illustrate these two processes and the relationship between them..

Next, divide students into small groups and distribute the materials to each group: sand or soil, small pebbles, clay or modeling dough, aluminum trays, water, a pitcher, plastic spoons or sticks. Instruct each group to create a miniature landscape in their container using the provided materials. They should layer sand, pebbles, and clay to simulate sediment layers. Have them predict what will happen when they pour water over the landscape.

Then, have students pour water slowly over their landscapes and observe how erosion and sedimentation occur. Encourage them to use the plastic spoons or sticks to simulate natural forces like rain or flowing water. Encourage them to discuss in their groups what the changes are that they observed and how their landscape was shaped by the water. They can repeat the simulation with additional water pours to further model the processes.

Last, reconvene as a class and discuss the results of the erosion simulation experiment together. Ask students to share their observations and explanations for the changes in their landscapes. Facilitate a discussion to help them extend their thinking and apply their model to the natural world around them. Have them discuss how this simulation models erosion and its impact on geological formations. Be sure to point out that by rock hunting, people can learn how erosion and sedimentation have shaped an area and moved rocks from far away to nearby.

ACTIVITY 5: ROCK HUNTING IN YOUR COMMUNITY



The purpose of this multi-day* project is to engage students in an immersive exploration of rocks and minerals in their local community, while developing their observation, research, and presentation skills. **Note: this project can be extended over the course of several days, weeks, or months as you choose to adapt it.*

Materials:

- Notebooks or science journals
- Pencils or pens
- Rulers (for measurements)
- Magnifying glasses or hand lenses
- Collection bags or boxes for rocks
- Digital cameras or smartphones (optional)

First, inform students that they will be conducting a research project to learn about the rock types in their local community.

Next, allow students to find partners to work with on the project and give students time to plan their project according to the given framework.

Then, create opportunities for students to work on their project in, and outside of, class time. Provide checkpoints at scheduled times to help students chunk the project and stay on track.

Last, when the research projects are completed. Allow students the opportunity to present their findings to the class.

Project Framework

The aim of this project is for students to learn about the rocks present in their area by researching their geographic area, rock hunting in their community, accurately identifying and classifying the rock types they find, recording detailed observations, and presenting their findings to others.

1. Introduction and Background Research

- Give students time to plan out in which area(s) (e.g., parks, beaches, riverbeds, or hiking trails) they will rock hunt and to research the common types of rocks to find in that region
- Have them come up with a collection plan, schedule, and map to track rocks
- Be sure to inform and involve parents about this project so that students can explore their community in safe ways

2. Rock Identification and Collection

- Encourage students to observe and record the location, appearance, color, texture, and any visible minerals or patterns on the rocks they collect.
- They can also take photographs to document their discoveries.

3. Research and Classification

- In class or at home, students research and identify their rocks and then classify the rocks based on what they've learned.

4. Presentations

- Students make a presentation to show their rocks, research, and classifications, followed by their favorite rock's details and interesting facts.
- They might present their projects to classmates, teachers, or parents.

5. Reflection and Conclusion

- Have students summarize class findings and recap their learning

LESSON CLOSURE

After the conclusion of all the activities, help students to make connections* between everything they did in the lesson and what they learned overall.

A. Free Recall

Group students in pairs or triads (e.g., in groups of 2-3 partners) and distribute the **Free Recall Protocol handout**, Alternatively, you can have students do this in their notebooks. Set a 3-min timer and have students generate a list of everything they can remember learning about in this lesson related to the central topic of the lesson. This doesn't have to be in depth, just whatever each group can call to mind. Have them draw lines between any terms that relate to one another. After the timer finishes, give groups a chance to volunteer to share aloud 2-3 things from their free recall lists and any of the connections that they made with those. Jot down any ideas that come up multiple times during the shareout for the whole group to see.

B. Lesson Synthesis

Give students individual thinking and writing time in their notebooks to synthesize their learning, by jotting down their own reflections using the **Word, Phrase, Sentence Protocol.**

In the Word-Phrase-Sentence Protocol, students write:

- A **word** that they thought was most important from the lesson
- A **phrase** that they would like to remember
- A **sentence** that sums up what they learned in the lesson

C. Cool Down

After the individual synthesis is complete, students should share their synthesis with a partner.

After sharing their syntheses, have students complete a **3, 2, 1 Review** for the lesson with their partner, recording in their notebooks or, optionally, on exit ticket slips to submit, each of the following:

- **3 things** that they liked or learned
- **2 ideas** that make more sense now
- **1 question** that they were left with

Invite several students to share aloud what they wrote in either the synthesis or 3, 2, 1 Review.

Lastly, ask one student volunteer to summarize what has been heard from the students as a final summary of student learning.

**Optionally here, the teacher can revisit the learning objectives and make connections more explicit for students.*

Teaching Tip: Use the Student Handouts to help students organize their thinking in writing around each of the lesson protocols.

NAME: _____

A Word, Phrase, Sentence Protocol

What is a **word** that you thought was most important from this lesson?

What is a **phrase** that you would like to remember from this lesson?

What is a **sentence** that sums up what you learned in this lesson?

3, 2, 1 Review Protocol

What are **3 things that you liked or learned** from this lesson's activities?

-
-
-

What are **2 ideas that make more sense** now to you?

-
-

What is **1 question that you were left with** after this lesson?

-

NAME: _____

Notice & Wonder Protocol

NOTICE	WONDER
Things that you noticed about the topic	*Things that you wondered about the topic*

NAME: _____

Rose, Thorn, Bud Protocol

ROSE

Something that "blossomed" for you in your learning

THORN

Something that challenged your thinking or was difficult to understand

BUD

Something that's new and growing in your mind — a "budding" idea

NAME: _____

4 Notes Summary Protocol

OOOH!

Something that was interesting to you

AAAH!

Something that became clearer; an "ah-ha" moment

HMMM...

Something that left you wanting to learn more

HUH?

Something you questioned or wondered

Sum It Up Statement:

Summarize your group discussion about your 4 Notes Summaries below:

NAME: _____

Think Pair Square Protocol

THINK

Write down your own individual ideas

PAIR

Summarize what you and your partner discussed

SQUARE

Summarize what your group discussed

NAME: _____

Free Recall Protocol

With 1-2 partners, generate a list of everything you can remember learning about in this lesson related to the central topic of the lesson. Draw lines between any terms that relate to one another.