

Sample Science Learning Plan

Big Idea/ Topic

Earth and Changes Over Time - Erosion & Weathering

Standard Alignment

This sample only focuses on the forces of erosion and weathering portion of the GSE for science.

S5E1. Obtain, evaluate, and communicate information to identify surface features on the Earth caused by constructive and/or destructive processes.

- Construct an argument supported by scientific evidence to identify surface features (examples could include deltas, sand dunes, mountains, volcanoes) as being caused by constructive and/or destructive processes (examples could include deposition, weathering, erosion, and impact of organisms).
- Develop simple interactive models to collect data that illustrate how changes in surface features are/were caused by constructive and/or destructive processes.
- Ask questions to obtain information on how technology is used to limit and/or predict the impact of constructive and destructive processes. (Clarification statement: Examples could include seismological studies, flood forecasting (GIS maps), engineering/construction methods and materials, and infrared/satellite imagery.)

Crosscutting Concepts: Cause and Effect

Connections to Other Content Areas:

ELAGSE5W2: Write informative/explanatory texts to examine a topic and convey ideas and information clearly.

- Introduce a topic clearly, provide a general observation and focus, and group related information logically; include formatting (e.g., headings), illustrations, and multimedia when useful to aiding comprehension.
- Develop the topic with facts, definitions, concrete details, quotations, or other information and examples related to the topic.
- Link ideas within and across categories of information using words, phrases, and clauses (e.g., in contrast, especially).
- Use precise language and domain-specific vocabulary to inform about or explain the topic.
- Provide a concluding statement or section related to the information or explanation presented.

ELAGSE5W8: Recall relevant information from experiences or gather relevant information from print and digital sources; summarize or paraphrase information in notes and finished work, and provide a list of sources.

ELAGSE5W9: Draw evidence from literary or informational texts to support analysis, reflection, and research.

ELAGSE5W10: Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline specific tasks, purposes, and audiences.

ELAGSE5L3: Use knowledge of language and its conventions when writing, speaking, reading, or listening.

ELAGSE5L4: Determine or clarify the meaning of unknown and multiple-meaning words and phrases based on grade 5 reading and content, choosing flexibly from a range of strategies.

a. Use context (e.g., cause/effect relationships and comparisons in text) as a clue to the meaning of a word or phrase.

b. Use common, grade-appropriate Greek and Latin affixes and roots as clues to the meaning of a word (e.g., photograph, photosynthesis).

c. Consult reference materials (e.g., dictionaries, glossaries, thesauruses), both print and digital, to find the pronunciation and determine or clarify the precise meaning of key words and phrases

SS5H3 Explain how the Great Depression and New Deal affected the lives of millions of Americans.

a. Discuss the Stock Market Crash of 1929, Herbert Hoover, Franklin Roosevelt, the Dust Bowl, and soup kitchens.

Instructional Design

Phenomenon: Erosion and Weathering in Providence Canyon State Park

Use the handout [Parent Letter](#) or write your own to inform parents/families about the instructional segment and materials they can gather for their child to successfully participate in the activities and investigations.

Engage

Use the phenomena of the landforms in Providence Canyon in Lumpkin, Georgia to begin the segment on erosion and weathering as destructive forces.

Help students understand that the results of the erosion and weathering (destructive) caused to the land's surface results in the rocks and soils deposition and sedimentation (constructive). It is important that they see the connection between the destructive and constructive. The rocks and soils do not disappear, they just change.

Plugged: In a synchronous setting have the students view a portion of the video: [Providence Canyon State Park](#). Do not show the entire 14-minute video. Use the segment between 5:00 and 7:30 minutes to show students the creek bed and walls of the canyon. (The world's largest sandcastle) Ask them to think about causes that could make these. Have them discuss their ideas and record ideas on a class chart. Continue to discuss the formation by asking questions such as if they think it is still getting deeper and wider? How long do they think it took to form? Students could watch on their own if asynchronous, but you may want to emphasize how to find the segment from the 5-minute mark to the 7 minute and 30 second mark.



Unplugged: Provide students with the handout [The Pictures of Providence Canyon](#). Have them record their thinking in writing or verbally about the possible causes for the formation. Ask them if they think it is still getting deeper and wider and to explain their thinking. Encourage them to think about how long they think it took to form.

What do they know?

Check to see where students fit in their understanding of weathering and erosion. This concept was introduced in third grade and students can link what they learned to their new thinking.

On the handout "[Erosion or Weathering? You Decide](#)," students will sort scenarios into two categories: weathering and erosion. A third column called undecided allows students to focus on learning. This is not for grading. This is to formatively assess their understanding. They can then do a follow up summary assessment after the instructional segment to change any of their ideas to show their line of learning.

Explore

This video gives students another look at the rock formations as well as explains the cause of the weathering and erosion that formed and is still forming Providence Canyon: the Georgia Explorer produced **Providence Canyon - Georgia's Little Grand Canyon**:

<https://www.youtube.com/watch?v=pEHpRiX8cRA>.

Teacher hint: For background information on how Providence Canyon's formation was due to poor farming practices visit [Teacher Notes – Providence Canyon's History](#).

- *Questioning is one of the keys to conducting successful inquiry-based learning activities. A KWL chart can help students raise questions as questions should come from the students whenever possible. Use the obtaining questions to help guide students through the KWL chart.*
- *An anticipation guide is a series of statements that students must respond to individually after viewing the phenomenon. The teacher's role is to activate thought and background knowledge. Statements can be marked as likely or unlikely that the statement has scientific basis for how Providence Canyon formed:*
 1. *Animals dug a hole first, then the hole just got bigger.*
 2. *Rain and wind made a hole, then the hole just got bigger.*
 3. *There was once a big lake, and suddenly all the water evaporated and left Providence Canyon.*
 4. *An earthquake cracked the Earth.*

Plugged: *For background information on how Providence Canyon's formation was due to poor farming practices: [Teacher Notes -Providence Canyon's History](#).* Have students research the history of Providence Canyon using the handout and the resource links to more information. Students can also use the State Park website <https://gastateparks.org/ProvidenceCanyon>.

Unplugged: Provide students with the handouts or brochures about the history of Providence Canyon. *For background information on how Providence Canyon's formation was due to poor farming practices: [Teacher Notes Providence Canyon's History](#)* - Provide copies of the resource linked information on the handout.



Explain

Students will use local resources in their quest of finding areas that show evidence of erosion or weathering caused by wind or rain.

Show students examples of erosion and weathering and challenge them to find local examples.

Plugged: Challenge students to document their evidence using pictures or videos uploaded into a presentation format to share with other students.

Unplugged: Challenge students to document their evidence by writing a story, drawing pictures, or mapping the area.

Elaborate

Have students compare the similarities and differences between the formation of the Grand Canyon and Providence Canyon. They are both formed by water erosion, but the Grand Canyon was formed by a river.

Plugged: Challenge students to research how the Grand Canyon was formed. A resource is <https://gpb.pbslearningmedia.org/resource/how-does-a-canyon-its-okay-to-be-smart/how-does-a-canyon-its-okay-to-be-smart/#.XzKnMHdFzJo> explaining that the surface of the Grand Canyon was eroded away by an inland sea and the Colorado River over millions of years.

Unplugged: Provide students will handouts, brochures, and articles on the Grand Canyon such as "[How does a river like the Colorado carve such a big canyon?](#)"

Evaluate

Students choose an explanation for how Providence Canyon formed by making inferences from the panoramic view.

For the teacher

- *Encourage students to create a narrative, an illustration with labels, a timeline, or a model to explain their reasoning.*
- *Encourage students to distinguish among facts, reasoned judgment, and speculation in an explanation.*

Communicating: Students share their explanations for the formation of Providence Canyon.

For the teacher

- *If possible, post or make available students' explanations. These can be referred to when clearing up misconceptions. They can also be used as teaching tools to further develop understanding of Earth's processes.*

If possible, keep the KWL chart or the anticipation guide, encouraging students to add to or change their thoughts based on evidence.

Plugged: Students can upload their work onto the class page to share with others.

Unplugged: Students can keep their work in a notebook or journal.

The teacher can schedule time, based on district guidance,

- for the student to share the work with a phone call
- for the student to take a picture of their work with the phone to text to the teacher



- for the parent to drop off the notebook at a designated location for the teacher to read, give feedback and return to the student at a scheduled time.

Part 2 Investigating Erosion and Weathering

For the teacher

- *Focus on S5E1b during this part of the lesson. Choose the above activities that help students develop models and gather data. Prepare in advance all the materials necessary for the activities you choose to complete with your class. Material list: water, clay, sand, pebbles, large metal baking pans, straws, sponge for moving water, plastic houses or small wooden blocks to simulate buildings, chalk, vinegar, paper towels, tongs or instrument to lift material out of water, clear plastic bottles with lids, coffee filter, foil, and cups.*
- *Provide a chart or wall space for students to post other questions they have and suggestions on how they could find answers: research or investigation.*
- *Use the activities as small group stations or partner labs.*
- *You do not have to use all the activities but ensure that students are inquiring and learning about several different processes.*
- *Have students complete activities at their own pace. Use formative assessment options as the students are working and interacting.*
- *Students may need to do some additional reading/research on Providence Canyon. <https://www.georgiaencyclopedia.org/articles/geography-environment/providence-canyon> Based on their experiences (relate back to labs) and their reading have them discuss the formation of Providence Canyon. Compare historical photos. How might it look in the future?*

For the teacher

Ask probing questions as students discover throughout the activities. Probing questions are open ended: How do you know? What is your evidence? What surprised you? What does this remind you of? Can you make any connections?

Getting Carried Away by Water Labs

- [Slowing the Effects of Rain](#)
- [Beachfront Property](#)
- [Weather or Not](#)
- [Water and Rocks](#)

Plugged: Have students and parents refer to the [Parent Letter](#) to compile the materials for the investigations. Provide students with the links to each investigation.

Look at these websites to investigate both before you go outside.

<http://wiki.kidzsearch.com/wiki/Erosion>

<http://wiki.kidzsearch.com/wiki/Weathering>

Unplugged: Have students and parents refer to the [Parent Letter](#) to compile the materials for the investigations. Provide students with copies of the articles if allowed.

Extension: [Acid Rain](#)

This activity is best done as a teacher demonstration unless you can get chalk to each student to do the investigation on their own. These materials are not listed in the Parent Letter.



Getting Carried Away by Wind Lab

Have students brainstorm a time when wind has caused damage to the land. Hurricanes and tornados move more than just wind when they come through. Another example from history is The Dust Bowl of the early 1930s. Students can relate what they learn about the Dust Bowl with how the conditions caused wind to cause so much destruction. Have students read the handout "[Timeline of the Dust Bowl](#)" and summarize how the land changed with the dust storms.

For the Teacher:

See the [wind lab set up](#). To create a simple stream table, use a plastic container or baking pan, and fill it on one end with soil. Slightly lift the end with soil and slowly pour or drop water over the soil on the lifted end (fill a cup with a small hole in the bottom with water and place on the lifted end of the container so that the water drops onto the soil/sand). Observe how the soil moves.

Plugged: The wind section of the [Wind and Water Erosion](#) investigation is **not safe for students** without goggles and supervision, so this can be used as a teacher demonstration. The teacher can video the demonstration to use as a resource for students. Also, students can view a video showing the effects of wind erosion from the Dust Bowl era: <http://www.pbs.org/kenburns/dustbowl/>

Unplugged: Have students talk with parents and others or tell about movies that give evidence that wind has caused damage. Challenge them to draw a before and after drawing showing how wind is a destructive force to the land.

Literature Link: Students can check books out from the library that tell them more about the effects of erosion. Public libraries in Georgia have access to many e-books. Reading both fiction and nonfiction books would be appropriate. For lists of award winning books, visit [NSTA](#) and [AAAS](#). Selected instructional materials should comply with your local system/s procedures and policies.

Writing to Show Understanding Have students research land forms caused by weathering and erosion such as the Hoodoos in Bryce Canyon: <https://www.nps.gov/brca/learn/nature/hoodoos.htm> or The 20 Most Famous and Amazing Rock Formations: <https://wanderwisdom.com/travel-destinations/Incredible-Rock-Formations>

Pictures from the Incredible Rock Formations website above are included in a PowerPoint presentation, "[Rock Formations](#) ."

Have students choose one of the pictures to "tell the story" of the rock formation. Students will write a narrative describing the rock formation based on evidence in rock patterns from the rock formation they choose and how it was changed over time.

Plugged: Provide students with the weblinks above or upload the PowerPoint to the class website. Include pictures of landforms such as the ones listed above to research.

Unplugged: Provide students with pictures of various landforms to use as their story base.



Culminating Activity: Encourage students to [Ask an Adult](#). A sample handout is included. They could interview a landscaper, gardener, county extension agent, contractor who works with new construction guidelines, parent, or other relative.

After students have conducted their interview, challenge them to use what they have learned to make a plan to control erosion or weathering where they live. Have them record their steps to find answers to the problems and the things they tried, who helped, materials they used, etc. Give them a due date for the project reminding them that this is a work in progress and that they may not have completed all the tasks by the due date.

Plugged: Have students take photos or videos to show the progress of their work. They can compile this work in a presentation format to share with you and other students. They can upload the information to the class website.

Unplugged: Have students document their progress with drawings, stories, and data. Schedule a time for them to drop off their work at a designated location so you can scan their documents into the class website for other students.

Evaluation:

Have students complete the assessment handout "[Erosion or Weathering? You Decide](#)." This has them explain how their understanding has changed. Allow them to change or add to any answers to show their line of learning.

For the teacher:

- *Students should revise, redraw, and rewrite their explanations from the Engage section to include their new information.*
- *At this point, teachers can add vocabulary that students have discovered to a word wall, to the KWL chart, or to student's self-collection dictionary.*

Questions and model to initiate class discussion: Discuss the different kinds of erosion you see in these images of the phenomenon or use the images and questions in this link:

[Images of Evidence of Erosion](#)

Additional questions:

- How do human activities contribute to erosion?
- Is erosion beneficial or harmful?
- What can you infer from the images about the geology of the area?
- What techniques can manage or prevent erosion?
- How are organisms impacted by the changing landscape? Can they adapt or change their behavior?

For the teacher:

- *Focus on S5E1 a and c during this part of the lesson. Students should connect their exploration of constructive and destructive processes to the formation of landforms, the technology used by humans that increase or slow the processes, and the impact that the processes and technology have on organisms. Teachers can offer prompts for writing and*



discussions such as: *There is a mound of dirt in the school yard. How will it change over time? What forces will change it?*

- All writing prompts and quizzes are an opportunity to enhance learning, adjust thinking, and clear up misconceptions.

Have students brainstorm testable questions and make a quiz using these.

Additional Activities for Assessment:

- Go back to the original questions and have students write a micro-theme (mini-essay that limits the space to write by using an index card or a half sheet of paper), A Point of View Guide (students write narrative where the processes become the characters of the narrative), an Unsent Letter (students write to a friend or relative to explain what they have learned about Providence Canyon), or a double entry journal (where the teacher uses vocabulary, questions, or prompts on the left side of a paper and the student responds on the right side).
- Add to the KWL chart
- Have students conduct a web quest to find out more about Providence Canyon.
- Write quizzes and tests to include questions about the cause and effect of erosion and resulting deposition.

Next Steps

Engaging/Ask: Are all mountains and valleys made by erosion and deposition? Challenge them to explain their thinking about other processes that form mountains.

Phenomenon: Yellowstone National Park contains evidence of many different processes that change the Earth's surface.

Lesson Goals Checklist

- Develop an understanding of how Earth's surface processes change land and features such as mountains, valleys, and islands as well as seafloor features such as trenches, ridges, and seamounts through the mechanisms of erosion, deposition, weathering, faults, and volcanism.
- Develop an understanding for the natural processes that work together to continually shape the surface of Earth through constructive and destructive forces.
- Compare multiple solutions designed to slow or prevent wind or water from changing the shape of the land.
- Use data from models developed in the Getting Carried Away labs to construct a reasonable explanation of how weathering and erosion shape the surface of the Earth.
- Communicate investigations and explanations to peers.
- Understand that the surface of the Earth changes. Some changes are due to slow processes such as weathering and erosion.
- Recognize that scientists monitor seismic activity using different methods of technology to help better understand the changes in the Earth's surface.

Supplies

- Notebook or Journal (can be online or written)
- Pencils for recording data and writing
- water
- clay, sand, soil
- pebbles

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- large baking pans
- grass seeds or grassy plot
- straws, (*Teacher demo*)
- sponge for moving water
- plastic houses or small wooden blocks to simulate buildings
- chalk (*optional for activity Acid Rain*)
- vinegar (*optional for activity Acid Rain*)
- paper towels
- tongs or instrument to lift material out of water
- clear plastic bottles with lids (*Safety Caution: Make sure students know to only use plastic. No glass.*)
- coffee filters
- foil
- cups

Handouts & PowerPoint

- [Acid Rain](#)
- [Ask an Adult](#)
- [Beachfront Property](#)
- [Dust Bowl Timeline](#)
- [Erosion or Weathering You Decide](#)
- [How does a river carve a canyon?](#)
- [Images of Evidence of Erosion](#)
- [Pictures of Providence Canyon in Lumpkin](#)
- [Rock Formations](#)
- [Slowing the Effects of Rain](#)
- [Water and Rocks](#)
- [Weather or Not](#)
- [Wind and Water Erosion Chart](#)

Evidence of Student Success

- Erosion or Weathering handout
- Student journals

Student Learning Supports

The goal for science education in the state of Georgia is as follows: All Students, over multiple years of school, actively engage in science and engineering practices and apply crosscutting concepts to deepen their understanding of the core ideas in these fields.

The learning experiences provided for students should engage them with fundamental questions about the world and with how scientists have investigated and found answers to those questions. This lesson includes the disciplinary core ideas, science and engineering practices and crosscutting concepts to actively engage students in exploring science concepts with real world topics. As part of the vision we must support the inclusion of all students in science learning.

Some **general** things to consider when planning for students supports include the following;

- Provide positive and consistent feedback.



- Keep directions brief and clear.
- Make sure parents and students know schedules, due dates, requirements, expectations, and how assignments/tests are going to be collected.
- Share evaluation results in a timely manner to students and parents.
- Package assignments in a way that students know the sequence, what is required, when it is required, what is available as choice and what is for fun.
- Provide/encourage organizational strategies such as where to work, store work, when and where to turn in assignments, graphic organizers, etc.
- Provide reminders of important dates and requirements.
- Go over notebook and journal ideas and share your entries with students so they can see what you expect.
- Allow dictation and/or text to speech software programs and tools.
- Check in with students by phone or online to answer questions, give reminders, and check progress.
- Provide parents with updates on progress and upcoming assignments. Communicate often.
- Provide resources that students can access offline.
- Allow students to give information orally or in drawings.
- Model expectations and demonstrations in video/online/phone.

Some considerations, **specific to this lesson**, are as follows:

- The teacher should be sure to turn on closed captions for videos.
- The teacher should have clear and consistent guidelines for sharing, discussing and collaborating in the class space.
- The teacher should consider guiding questions as needed to help students recall information that they have learned in the past.
- The teacher should consider adding some questions to the pictures of Providence Canyon to assist students in evaluating images.
- The teacher should consider providing unplugged students/parents an answer key to the card sort activity. This could include an explanation to help parents go over the answers and reason for the answers with students.
- The teacher should consider providing students with links or articles to use as resources for their research.
- The teacher may need to consider providing students with some basic questions to guide their research.
- The teacher should consider graphic organizers to help students compare and contrast Providence Canyon and the Grand Canyon.
- The teacher should consider providing students with sentence frames to start off any writing that the students need to do.
- The teacher should consider articles, images and ways for students to observe erosion around their home. Some students will not have the resources to complete the demo at home.
- The teacher should consider asking students about personal experiences with erosion and wind. This can help students make the connection between their lives and the science concepts.
- The teacher should consider multiple formats of sharing information and students showing knowledge.



Engaging Families

- [Dear Parent Letter](#)
- [Science Support for Families During School Closures](#)
- [Sample Learning Menu Strategies for K-12 Science](#)
- [GPB Home Classroom](#)

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Dear Parent or Caregiver,

This instructional segment in science is about how the land is built up (earthquakes and volcanoes) and how the land is torn down (erosion and weathering). The investigations will involve exploring how wind and water affect the soil and rocks and using models.

It will help to find a specific location for your child to investigate soil. This could get messy, so perhaps a location in the yard or somewhere outside is better than inside. A materials place (shoe box or tote bag) will help your child locate and store what is needed so you will not have to go searching during the class.

Here are the materials needed for this segment in science:

- Container for water (cup or pitcher for pouring)
- A place for digging and observing—yard, garden, or tub (think baking pan) of soil, etc.
- Straws (like the ones you get at restaurants and drive thrus)
- Sponge
- Blocks or rocks (to model houses and buildings)
- Coffee filters or paper towels
- Cups (Styrofoam or paper cups)
- Clear plastic bottles with lids (think empty water or juice bottles)
- Grass seeds to grow and see the root structure (or a place outside with grass growing)
- Paper towels
- A place for your child to clean up outside before coming in with muddy hands



Pictures of Providence Canyon in Lumpkin, Georgia



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Providence Canyon is in Lumpkin, Georgia. Here is a map of Georgia to show you where it is located and a photo of the city so you can see where people live. The State Park is in this area of Georgia. It has sandy soil mixed with red clay.

Information about the soil:

The Providence Canyon lies in a region that was formed by deposition of marine sediments between 59 and 74 million years ago. The soil in the top part of the canyon wall was deposited about 60-65 million years ago, just after the age of the dinosaurs. Its fairly coarse sand is a reddish color caused by the presence of iron oxide.

Underneath this formation lies what is known as the Providence Sand, which makes up most of the canyon walls. It is one hundred and nineteen feet thick and was deposited about 70 million years ago. The upper part of this layer is very fine sand mixed with a white clay. The middle layer is coarse and more colorful, with beds of yellow (limonite) and purple (manganese) deposits. The lowest and oldest layer is a black and yellow mica-rich clay. The bottom of the canyon floor was deposited about 70-74 million years ago and is orange in color but is poorly exposed and overgrown by vegetation.

Questions

1. What do you think caused these land formations?

2. Do you think the canyons are getting wider or deeper?

3. How long do you think it took these canyons to form?



Erosion or Weathering? You decide.

Remember: Erosion involves carrying or moving the material. Weathering involves wearing or breaking down material.

Read the scenario list and put a mark in the chart to show your thinking. Give a reason for your choice.

An example is provided for you.

Scenarios

Example: During a heavy rain, the side of a cliff is washed down to the canyon floor.

1. A rock is broken into smaller rocks because of water freezing in the cracks.
2. Soil is washed downstream in a river.
3. Wind carries particles of sand that carves away part of a mountain.
4. An animal digs a hole in the soil to make a new home.
5. Rocks are worn smooth by a fast-flowing river.
6. A mudslide carries trees down a steep hill.
7. A sandstorm covers up a garden path.
8. A tree grows under a rock and the roots split the rock into smaller pieces.

	Erosion	Weathering	Undecided	My reasoning for this answer
Example	X			Because the side of the cliff is moved by the water
A				
B				
C				
D				
E				
F				
G				
H				



_____ My Line of Learning _____

You will complete this part after instruction. Store the handout with your answers above until the teacher asks you to complete the next set below.

Explain some ways your thinking has changed after you have completed your work on erosion and weathering:

I used to think

Now I know



How does a river like the Colorado carve such a big canyon?

Excerpt from the Geology section of the National Park Service website on the Grand Canyon:

<https://www.nps.gov/grca/learn/nature/grca-geology.htm>

Grand Canyon's upper layers. NPS Photo



Grand Canyon is the result of a distinct and ordered combination of geologic events. The story begins almost two billion years ago with the formation of the igneous and metamorphic rocks of the inner gorge. Above these old rocks lie layer upon layer of sedimentary rock, each telling a unique part of the environmental history of the Grand Canyon region. Then, between 70 and 30 million years ago, through the action of plate tectonics, the whole region was uplifted, resulting in the high and relatively flat Colorado Plateau.

Finally, beginning just 5-6 million years ago, the Colorado River began to carve its way downward. Further erosion by tributary streams led to the canyon's widening. Still today these forces of nature are at work slowly deepening and widening the Grand Canyon.

Horizontal striations can be found in the walls of the majority of the canyon.



Deposition of Grand Canyon rocks - The story of how Grand Canyon came to be begins with the formation of the layers and layers of rock that the canyon winds through. The story begins about 2 billion years ago when igneous and metamorphic rocks were formed. Then, layer upon layer of sedimentary rocks were laid on top of these basement rocks. To look at rock layers, geologists use a diagram called a stratigraphic column. It shows the rock layers with the oldest on the bottom, and the youngest on the top. That means that the bottom layer was formed first, and every subsequent layer was formed later, with the youngest rocks on the top.

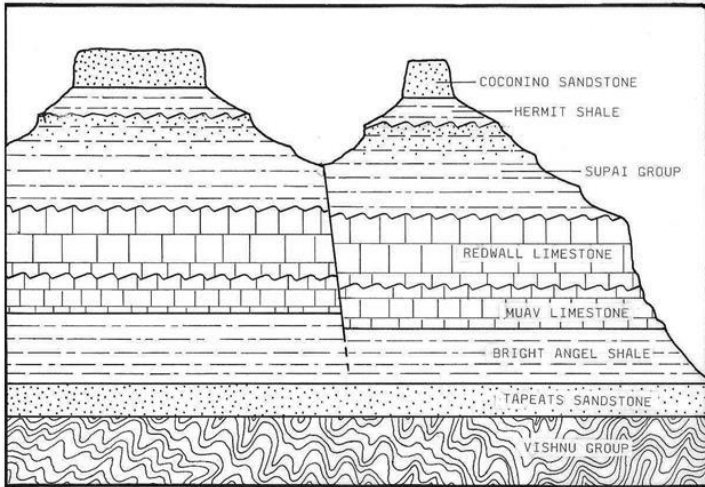
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In geology, this is referred to as the principle of superposition, meaning rocks on the top are generally younger than rocks below them. Another important principle is the principle of original horizontality. This means that all the rock layers were laid horizontally. If rock layers appear tilted, that is due to some geologic event that occurred after the rocks were originally deposited.

Grand Canyon striations



What is a Valley? What is a Canyon?

A valley is a landform characterized by a low-lying area of land surrounded by high areas, such as mountains or hills. Valleys can be a wide variety of shapes and sizes. They are either erosional features, carved by water or glacial ice, or structural features, caused by rifting.

A canyon is a type of erosional valley with extremely steep sides, frequently forming vertical or nearly vertical cliff faces. The term “gorge” is often used interchangeably with “canyon” and generally implies a smaller, particularly narrow feature.

The Colorado River has been carving away rock for the past five to six million years. Remember, the oldest rocks in Grand Canyon are 1.8 billion years old. The canyon is much younger than the rocks through which it winds. Even the youngest rock layer, the Kaibab Formation, is 270 million years old, many years older than the canyon itself.



Slowing the Effects of Rain

Materials Needed

- large pan (like an aluminum baking pan)
- watering can or paper cup with holes at the bottom
- grass growing in soil or sand and soil

Procedure:

1. Put a layer of sand and soil or soil in the bottom of a large pan.
2. A few days before doing the erosion investigation, plant some grass seeds in half the pan of soil or find a place where grass is growing on a slope with bare patches.
3. Sketch what you see.
4. Use your watering can or cup to “rain” on the grass and on the bare soil.
5. Describe in a second sketch or write a paragraph about what happened.
6. When did the water flow more quickly? Was any of the soil washed away?
7. How can you prevent soil loss on a bare patch in your home yard or school yard?
8. How does this activity help you understand the impact of vegetation on a hillside?



Beach Front Property

Materials Needed

- Plastic tub or metal backing pan
- Sand
- Wooden block or sponge
- Water
- Plastic houses, small objects or blocks



Procedure

1. Place the plastic houses or blocks on the sand a few inches from the edge of the water.
2. Measure the distance from the houses to the edge of the beach. Measure the area that the sand covers. Draw what the beach looks like once you have set it up, and label it with your measurements.
3. Then draw a profile of the beach and include the measurements. (A profile is how the beach looks when you view it from the side of the container).
4. Place the wooden block or sponge in the container at the opposite end of the sand. Move it back and forth to create ten gentle waves. Make sure you are holding the block parallel to the beach.
5. Measure the area that the sand covers and the distance from the houses to the edge of the water. Draw a picture of the beach and the profile after this step, include the measurements.
6. Now repeat the steps but create ten stronger “storm strength” waves.

What do you understand about moving water as an agent of erosion? How do you know?

Weather or Not the School Grounds or Playground (or yard)

The process that breaks down rocks is called weathering. The process that carries away debris is called erosion. Look at these websites to investigate both before you go outside.

<http://wiki.kidzsearch.com/wiki/Erosion> <http://wiki.kidzsearch.com/wiki/Weathering>

There are two types of weathering:

1. Physical weathering is when a rock is broken into smaller and smaller pieces. This process could be a result of the following:

Alternating water's freezing and thawing action

Plant roots wedging the rock apart

Burrowing animals moving soil and rocks

The breaking up of rock due to human activity

2. Chemical weathering is when the rocks change due to different chemical reactions. This process could be a result of one of the following:

When water and iron oxidize and become rust.

When a mild acid from rain water deteriorates the rock, paint, or building's surface.

Explore your school's grounds and playground looking for the effects of weathering.

What is weathered?	What type of weathering occurred?
What is eroded?	How was it eroded?



Water and Rocks 1

1. Fill a large, clear, plastic container with a lid about halfway with equal amounts of sand, soil, small gravel.
2. Fill the jar with water and tighten the lid.
3. Shake the jar for 1 minute.
4. Set the jar on a shelf or table.
5. Observe the jar after 20 minutes.
6. Draw what you see, label the particles.
7. Analyze your findings.

Water and Rocks 2

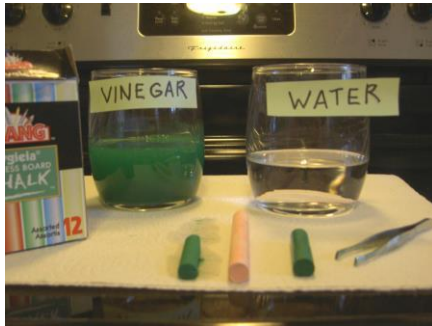
1. Gather 1 cup of rocks. Place $\frac{1}{2}$ cup of rocks into a plastic bottle with a lid.
2. Place the other $\frac{1}{2}$ cup of rocks onto a paper plate.
3. Fill the bottle halfway with water.
4. Close the lid and shake the bottle for 10 minutes.
5. Pour the water out of the jar and into another container through a coffee filter so that all the debris is caught.
6. Compare the rocks in the coffee filter to those that you placed on the paper plate.
7. Compare and contrast the two piles of rocks.
8. Examine the water. Is it still clear?

CER (Claim, Evidence, Reasoning)

1. Make a claim about how water causes changes in rocks.
2. Support your claim with evidence.
3. Build an argument for your claim through reasoning.



Acid Rain



Materials:

1. Cup of water
2. Cup of vinegar
3. Two pieces of chalk
4. Tweezers or tongs
5. Magnifying glass
6. Paper towel

Procedure

1. Break one piece of chalk in half.
2. Weigh each piece of chalk. (If you don't have access to you may record observations.)
3. Write the weight of the first chalk and label it sample A.
4. Write the weight of the second chalk and label it sample B.
5. Place chalk sample A in the cup with water.
6. Place chalk sample B in the cup with vinegar.
7. Set your timer for 5 minutes.
8. Record your observations of the pieces of chalk in each of the cups.
9. After the 5 minutes, use the tongs to remove each piece of chalk and place them on a paper towel.
10. Weigh them again. Record your findings.
11. Use the magnifying glass to observe the changes that occurred to each piece of chalk.
12. Analyze your data.

How do chemicals in rainwater affect weathering?

The Dust Bowl Timeline

1931

Severe drought hits the Midwestern and Southern Plains. As the crops die, the “black blizzards” begin. Dust from the over-plowed and over-grazed land begins to blow.

1932

The number of dust storms is increasing. Fourteen are reported this year; next year there will be 38.

March 4, 1933

When Franklin Roosevelt takes office, the country is in desperate straits. He will take quick steps to declare a four-day bank holiday, during which time Congress will come up with the Emergency Banking Act of 1933, which stabilizes the banking industry and restores people’s faith in the banking system by putting the federal government behind it.

May 12, 1933

The Emergency Farm Mortgage Act allots \$200 million for refinancing mortgages to help farmers facing foreclosure. The Farm Credit Act of 1933 establishes a local bank and sets up local credit associations.

June 18, 1933

The Civilian Conservation Corps opens the first soil erosion control camp in Clayton County, Alabama. By September there will be 161 soil erosion camps.

September 1933

Over 6 million young pigs are slaughtered to stabilize prices. With most of the meat going to waste, public outcry will lead to the creation, in October, of the Federal Surplus Relief Corporation. The FSRC will divert agricultural commodities to relief organizations. Apples, beans, canned beef, flour and pork products will be distributed through local relief channels. Cotton goods are eventually included to clothe the needy as well.

October 4, 1933

In California’s San Joaquin Valley, where many farmers fleeing the plains have gone seeking migrant farm work, the largest agricultural strike in America’s history begins. More than 18,000 cotton workers with the Cannery and Agricultural Workers Industrial Union (CAWIU) strike for 24 days. During the strike, two men and one woman are killed and hundreds injured. In the settlement, the union is recognized by growers, and workers are given a 25 percent raise.

May 1934

Great dust storms spread from the Dust Bowl area. The drought is the worst ever in U.S. history, covering more than 75 percent of the country and affecting 27 states severely.

June 28, 1934

Roosevelt signs the Taylor Grazing Act, which allows him to take up to 140 million acres of federally owned land out of the public domain and establish grazing districts that will be carefully monitored. One of many New Deal efforts to heal the damage done to the land by overuse, the program can arrest the deteriorations but cannot undo the damage that has already been done.

This same day, the Frazier-Lemke Farm Bankruptcy Act is approved. This act restricts the ability of banks to dispossess farmers in times of distress. Originally effective until 1938, the act will be renewed four times until 1947, when it will expire.

December 1934

The “Yearbook of Agriculture” for 1934 announces, “Approximately 35 million acres of formerly cultivated land have essentially been destroyed for crop production.... 100 million acres now in crops have lost all or most of the topsoil; 125 million acres of land now in crops are rapidly losing topsoil....”



April 8, 1935

FDR approves the Emergency Relief Appropriation Act, which provides \$525 million for drought relief, and authorizes creation of the Works Progress Administration, which will employ 8.5 million people.

April 14, 1935

Black Sunday. The worst “black blizzard” of the Dust Bowl occurs, causing extensive damage.

April 27, 1935

Congress declares soil erosion “a national menace” in an act establishing the Soil Conservation Service in the Department of Agriculture (formerly the Soil Erosion Service in the U.S. Department of Interior). Under the direction of Hugh H. Bennett, the SCS will develop extensive conservation programs that retain topsoil and prevent irreparable damage to the land. Farming techniques such as strip cropping, terracing, crop rotation, contour plowing, and cover crops are advocated.

Farmers are paid to practice soil-conserving farming techniques.

January 15, 1935

The federal government forms a Drought Relief Service to coordinate relief activities. The DRS buys cattle in counties that are designated emergency areas, for \$14 to \$20 a head. Those unfit for human consumption – more than 50 percent at the beginning of the program – are destroyed. The remaining cattle are given to the Federal Surplus Relief Corporation to be used in food distribution to families nationwide. Although it is difficult for farmers to give up their herds, the cattle slaughter program helps many of them avoid bankruptcy. “The government cattle buying program was a God-send to many farmers, as they could not afford to keep their cattle, and the government paid a better price than they could obtain in local markets.”

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December 1935

At a meeting in Pueblo, Colorado, experts estimate that 850,000,000 tons of topsoil has blown off the Southern Plains during the year, and that if the drought continues, the total area affected would increase from 4,350,000 acres to 5,350,000 acres by the spring of 1936. C.H. Wilson of the Resettlement Administration proposes buying up 2,250,000 acres and retiring it from cultivation.

February 1936

Los Angeles Police Chief James E. Davis sends 125 policemen to patrol the borders of Arizona and Oregon to keep “undesirables” out. Thus, the American Civil Liberties Union sues the city.



May 1936

The SCS publishes a soil conservation district law, which, if passed by the states, would allow farmers to set up their own districts to enforce soil conservation practices for five-year periods. One of the few grassroots organizations set up by the New Deal still in operation today, the soil conservation district program recognized that new farming methods needed to be accepted and enforced by the farmers on the land rather than bureaucrats in Washington.

January 20, 1937

Roosevelt addresses the nation in his second inaugural address, stating, "I see one-third of the nation ill-housed, ill-clad, ill-nourished... the test of our progress is not whether we add more to the abundance of those who have much; it is whether we provide enough for those who have too little."

March 1937

FDR's Shelterbelt Project begins. The project calls for large-scale planting of trees across the Great Plains, stretching in a 100-mile wide zone from Canada to northern Texas, to protect the land from erosion. Native trees, such as red cedar and green ash, are planted along fence rows separating properties, and farmers and workers from the Civilian Conservation Corps are paid to plant and cultivate them. The project is estimated to cost 75 million dollars over a period of 12 years. When disputes arise over funding sources (the project was considered to be a long-term strategy, and therefore ineligible for emergency relief funds), FDR transfers the program to the WPA, where the project had limited success.

1938

The extensive work re-plowing the land into furrows, planting trees in shelterbelts, and other conservation methods has resulted in a 65 percent reduction in the amount of soil blowing. However, the drought continues.

1939

In the fall, the rain comes, finally bringing an end to the drought. During the next few years, with the coming of World War II, the country is pulled out of the Depression and the plains once again become golden with wheat.



Wind and Water Erosion Data Chart

	What I predict will happen:	What actually happened:	Place several rocks around the soil and observe what happened. Do the rocks make a difference in how the soil eroded?	Draw a diagram of what happened:
Stream Table				
Wind Demo by Teacher				



Ask an Adult

Your mission is to find out more about erosion in your personal life. Talk with an adult about erosion/weathering problems they have encountered and the methods they took to solve those problems.

Person Interviewed:

Date of interview:

Sample ideas of inquiry: (Remember that this is your interview so you can ask other questions. Just write down the question you asked and their answers as best you can.) You could also record or video the interview with their permission.

1. Please tell me about when you had a problem with erosion by heavy rains, wind storms, etc.
2. What did you do to control the problem?
3. What did not work? What did work?
4. Did you have to get help from someone else?
5. Are there erosion problems where we live?

Did they give their permission for you to use their answers in this report?

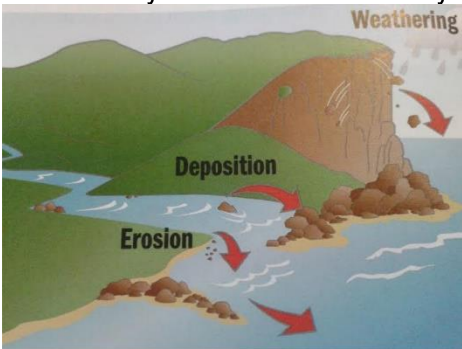
Explain how the interview went and what you learned.



Example Images of Erosion and Deposition for class and small group discussion

Sample Discussion Questions:

1. What changes do you see happening in these pictures?
2. What is the cause of the change?
3. What is the effect of the change?
4. Is this a constructive or destructive process or both?
5. Can you have one without the other?
6. Is there a way to prevent this from happening?
7. Do you know of areas in your own yard or school yard where this is a problem? What can you do?





These are after pictures of erosion. Choose one and draw or explain what the land probably looked like before the erosion. happened.