Moss on Rock

Earth & Space Science | Lesson Guide

4th Grade

Photo Description

This image shows bright green moss growing on weathered rocks. The moss forms thick, soft patches that cover parts of the rock surface. You can see different colored layers in the rock, including pink and gray sections, showing how the rock has changed over time.

Scientific Phenomena

The Anchoring Phenomenon is biological weathering - the process where living organisms break down rocks over time. The moss in this image is actively contributing to rock breakdown through both physical and chemical processes. As moss grows, its tiny root-like structures (rhizoids) penetrate small cracks in the rock, gradually widening them. Additionally, moss produces weak acids that slowly dissolve certain minerals in the rock, creating the weathered, layered appearance we observe.

Core Science Concepts

1. Weathering and Erosion: Living things like moss can break down rocks through physical pressure and chemical reactions, changing Earth's surface over long periods of time.

2. Interdependence in Ecosystems: Moss depends on the rock for a place to grow, while simultaneously changing the rock's structure, demonstrating how organisms interact with their physical environment.

3. Life in Extreme Environments: Moss can survive in harsh conditions where other plants cannot, showing how different organisms are adapted to specific environments.

4. Slow Changes to Earth's Surface: The layered rock colors visible in the image represent changes that happened over very long time periods, much longer than a human lifetime.

Pedagogical Tip:

Use a hand lens or magnifying glass to help students observe the detailed structures of moss and rock surfaces. This builds observation skills and helps students notice patterns they might miss with just their eyes.

UDL Suggestions:

Provide tactile experiences by bringing in different rock samples and dried moss for students to touch and compare. This supports learners who benefit from hands-on exploration and helps all students build concrete understanding before moving to abstract concepts.

Zoom In / Zoom Out

Zoom In: At the microscopic level, moss cells are producing carbonic acid and other weak acids that chemically react with rock minerals. The moss's rhizoids are also physically pushing into tiny spaces between rock crystals, creating pressure that slowly fractures the rock structure.

Zoom Out: This weathering process is part of the larger rock cycle that shapes Earth's surface. As rocks break down, they form soil that supports larger plants, which continue the weathering process. Over millions of years, entire mountain ranges can be worn down through these combined biological and physical processes.

Discussion Questions

1. What evidence do you see that the rock has changed over time? (Bloom's: Analyze | DOK: 2)
2. How might this rock look different in 100 years if the moss continues to grow on it? (Bloom's: Predict | DOK: 3)
3. What do you think would happen to the moss if this rock was moved to a desert environment? (Bloom's: Evaluate | DOK: 3)
4. Why do you think moss can grow on rocks but grass cannot? (Bloom's: Analyze | DOK: 2)

Potential Student Misconceptions

1. Misconception: "Only big things like hammers or earthquakes can break rocks."
   Clarification: Tiny living things like moss can break down rocks over time through slow, continuous processes.

2. Misconception: "Moss is hurting or killing the rock."
   Clarification: Rocks are not alive, so they cannot be hurt. Moss is simply changing the rock's shape and structure through natural processes.

3. Misconception: "This rock breaking happened quickly, like in a few days or weeks."
   Clarification: Biological weathering is an extremely slow process that takes many years or even centuries to create visible changes.

Cross-Curricular Ideas

1. ELA - Narrative Writing: Have students write a story from the perspective of a moss spore that lands on a rock. Where did it come from? How does it feel to grow on the rock? What changes does it see over time? This connects literacy skills with the concept of slow Earth changes.

2. Math - Measurement and Data: Students can measure the growth of moss over several weeks using a ruler or measuring tape. Create a simple graph showing how much the moss grew each week. This builds data collection and graphing skills while reinforcing that weathering is a slow, measurable process.

3. Art - Texture and Pattern Observation: Have students create a rubbing or sketch of moss-covered rocks, focusing on the different textures created by the moss, rock layers, and lichen. Display these alongside the original photo to show different ways of representing the same natural object.

4. Social Studies - Geography and Ecosystems: Research different biomes and discuss where moss grows naturally around the world. Create a map showing moss habitats and connect this to how Earth's surface features (mountains, valleys, rock formations) influence where different organisms can survive.

STEM Career Connection

1. Geologist: A geologist is a scientist who studies rocks, soil, and how Earth's surface changes over time. Geologists examine rocks like the ones in this photo to understand Earth's history and predict natural events. Some geologists even help find valuable minerals and resources underground. Average Annual Salary: $92,000 USD

2. Environmental Scientist: Environmental scientists study how living things interact with their surroundings, including how plants like moss help change landscapes. They work to protect nature and understand ecosystems. Some environmental scientists help restore damaged habitats by introducing plants that can naturally break down polluted soil. Average Annual Salary: $73,000 USD

3. Botanist: A botanist is a scientist who specializes in studying plants, including tiny plants like moss. Botanists examine how moss survives in tough environments and how it helps other organisms. Some botanists work to discover new plant species or find ways plants can be used in medicine and technology. Average Annual Salary: $68,000 USD

NGSS Connections

- Performance Expectation: 4-ESS1-1: Identify evidence from patterns in rock formations and fossils in rock layers to support an explanation for changes in a landscape over time.
- Disciplinary Core Ideas: 4-ESS1.C - The presence and location of certain fossil types indicate the order in which rock layers were formed
- Disciplinary Core Ideas: 2-ESS1.C - Wind and water can change the shape of the land
- Crosscutting Concepts: Patterns - Patterns in the natural world can be observed and used as evidence
- Crosscutting Concepts: Cause and Effect - Events have causes that generate observable patterns

Science Vocabulary

* Weathering: The process of breaking down rocks into smaller pieces over time.
* Moss: A small, simple plant that grows in damp places and doesn't have true roots.
* Erosion: The movement of weathered rock and soil from one place to another.
* Organism: Any living thing, including plants, animals, and other life forms.
* Environment: All the living and non-living things that surround an organism.
* Adaptation: A special feature that helps an organism survive in its environment.

External Resources

Children's Books:
- Rocks Hard, Soft, Smooth, and Rough by Natalie Rosinsky
- A Rock Is Lively by Dianna Hutts Aston
- The Magic School Bus Inside the Earth by Joanna Cole