Rock covered with Moss and Lichen

5th Grade

Earth & Space Science | Lesson Guide

Photo Description

This large rock shows different types of organisms living on its surface. Green moss patches and light-colored lichen create a colorful pattern across the weathered stone. The rock sits in a forest setting surrounded by fallen leaves and grass, showing how living things can grow on non-living surfaces.

Scientific Phenomena

The Anchoring Phenomenon is biological weathering and ecological succession on rock surfaces. This occurs when pioneer species like lichens and mosses colonize bare rock surfaces. Lichens produce acids that slowly break down the rock, creating small amounts of soil where mosses can then establish. Over time, this process creates conditions for larger plants to grow, demonstrating how living organisms can change their physical environment and create habitats for other species.

Core Science Concepts

1. Biological Weathering: Living organisms like lichens break down rock through chemical processes, slowly creating soil over long periods of time.

2. Pioneer Species: Lichens are among the first organisms to colonize bare rock because they can survive in harsh conditions with minimal nutrients and water.

3. Ecosystem Interactions: The relationship between lichens, mosses, and the rock demonstrates how organisms modify their environment and create conditions for other species.

4. Matter Cycling: Organic matter from decomposing organisms mixes with weathered rock particles to form soil, showing how matter moves between living and non-living components.

Pedagogical Tip:

Have students make detailed observations of the rock surface before explaining the science concepts. This builds their observation skills and allows them to construct their own explanations before learning the scientific terms.

UDL Suggestions:

Provide hand lenses or magnifying glasses for students to examine similar rocks outdoors. Create texture rubbings of different rock surfaces to help tactile learners understand the concept of weathering through hands-on experience.

Zoom In / Zoom Out

1. Zoom In: At the microscopic level, lichen organisms produce weak acids that chemically break the bonds between mineral crystals in the rock. Fungal threads (hyphae) grow into tiny cracks, physically expanding them as they absorb water and grow.

2. Zoom Out: This weathering process is part of the larger rock cycle, where rocks are continuously broken down and reformed. The soil created here will eventually support larger plants, contributing to forest ecosystem development and carbon cycling on a global scale.

Discussion Questions

1. What evidence do you see that living things can change non-living things? (Bloom's: Analyze | DOK: 2)

2. How might this rock look different in 100 years, and what factors would cause those changes? (Bloom's: Evaluate | DOK: 3)

3. Why do you think lichens can grow on bare rock while other plants cannot? (Bloom's: Analyze | DOK: 2)

4. How does the weathering of this rock connect to soil formation in the forest ecosystem? (Bloom's: Synthesize | DOK: 3)

Potential Student Misconceptions

1. Misconception: "Moss and lichen are the same thing."
   Clarification: Moss is a simple plant, while lichen is actually two organisms (fungus and algae) living together in a partnership called symbiosis.

2. Misconception: "Rocks don't change or break down naturally."
   Clarification: Rocks are constantly being broken down by weather, water, and living things through processes that happen very slowly over many years.

3. Misconception: "Only big things like hammers can break rocks."
   Clarification: Tiny organisms can break down rocks through chemical reactions and slow physical processes, even though we can't see it happening day by day.

Cross-Curricular Ideas

1. Math - Measuring Change Over Time: Have students create a graph showing how much soil might accumulate on a rock surface over different time periods (10 years, 50 years, 100 years). They can research estimates and practice creating bar graphs or line graphs to visualize the slow process of weathering. This connects to data analysis and predicting patterns.

2. ELA - Nature Journal Writing: Students can write descriptive paragraphs or poems about what they observe on rocks in nature. Have them use sensory language to describe the textures, colors, and patterns of moss and lichen. This builds descriptive writing skills while deepening their observational abilities in science.

3. Social Studies - Indigenous Knowledge: Research how different cultures have used rocks, soil, and plants for tools, medicines, and building materials. Students can learn that understanding how ecosystems change (like rock weathering creating soil) has been important knowledge for many communities throughout history.

4. Art - Nature Rubbings and Texture Art: Students can make rubbings of lichen and moss patterns on rocks using paper and crayons to capture the textured surface. They can arrange these rubbings into an art display showing the variety of patterns found in nature, celebrating the beauty of biological weathering.

STEM Career Connection

1. Geologist - Geologists study rocks, minerals, and soil to understand how Earth changes over time. They use tools like magnifying glasses and microscopes to examine rocks and fossils, and they often work outdoors exploring nature. Some geologists study how weathering breaks down rocks and creates soil, which helps us understand Earth's history. Average Salary: $95,000/year

2. Environmental Scientist - Environmental scientists study how living things and non-living environments interact, just like the moss and lichen on this rock! They work to protect nature and understand ecosystems. They might study how forests grow on weathered rock or how pollution affects plants and soil. Average Salary: $77,000/year

3. Botanist - Botanists are scientists who study plants, including mosses and lichens. They observe how plants grow in different environments and how they adapt to tough conditions like living on bare rock. Some botanists work in forests or gardens, while others work in laboratories examining plant cells under microscopes. Average Salary: $68,000/year

NGSS Connections

Performance Expectation: 5-ESS1-1 - Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact.

Disciplinary Core Ideas:
- 5-ESS2.A - Earth's major systems interact through physical and chemical processes
- 5-LS2.A - Organisms interact with the living and nonliving environment

Crosscutting Concepts:
- Systems and System Models
- Cause and Effect
- Stability and Change

Science Vocabulary

* Weathering: The process of breaking down rocks into smaller pieces through natural forces.
* Pioneer species: The first organisms to live in a new or harsh environment.
* Lichen: A partnership between fungus and algae that can grow on rocks and trees.
* Symbiosis: When two different organisms live together and help each other survive.
* Ecosystem: All the living and non-living things in an area that interact with each other.
* Biological weathering: When living things help break down rocks through chemical or physical processes.

External Resources

Children's Books:
- The Magic School Bus Inside the Earth by Joanna Cole
- Rocks and Minerals by Steve Tomecek
- A Seed Is Sleepy by Dianna Hutts Aston