

Caves of the National Parks: The Wonder Beneath

Teacher's Guide

Grade Level: K-8

Curriculum Focus: Physical Science

Lesson Duration: Three class periods

Program Description

Explore the underground cave systems of Mammoth Cave National Park in Kentucky, Hawaii Volcanoes National Park in Hawaii, and Carlsbad Caverns National Park in New Mexico. Learn how different caves are created and discover the amazing life forms that call these particular cave systems home.

Discussion Questions

- How are caves formed? What are some different types of caves?
 - What are the uses of caves?
 - Why is it important that we protect our caves through conservation measures?
 - What can we learn by studying caves?
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Lesson Plan

Student Objectives

- Write a research report about Mammoth Cave National Park, Hawaii Volcanoes National Park, and Carlsbad Caverns National Park.
- Demonstrate an understanding of why it is important that we protect cave systems.
- Compare Mammoth Cave National Park, Hawaii Volcanoes National Park, and Carlsbad Caverns National Park to one another

Materials

- *The Wonder Beneath* video and VCR, or DVD and DVD player
- Pencils and erasers
- Paper
- Glue or tape
- Scissors

- Magazines, travel brochures, park brochures, and other texts with information and images of Mammoth Cave National Park, Hawaii Volcanoes National Park, and Carlsbad Caverns National Park
- Computer with Internet access

Procedures

1. Use *Caves of the National Parks: The Wonder Beneath* to introduce different cave systems to the class. After watching the program, talk about the three cave systems that were highlighted (Mammoth Cave National Park in Kentucky, Hawaii Volcanoes National Park in Hawaii, and Carlsbad Caverns National Park in New Mexico). How were the caves formed? How are the cave systems different from one another? What kinds of organisms live in the caves?
2. Tell students that they are going to prepare a written report about one of the three parks highlighted in *Caves of the National Parks: The Wonder Beneath*. Each student may choose a park to research. The reports must be at least two written pages in length and include the following:
 - Location of the park
 - Number of annual visitors
 - Why people visit the caves
 - How and when the cave system was formed
 - Description of the cave system (size, depth, how much of it has been explored, appearance, etc.)
 - Ecosystem (troglobites and other animals that live in or above the caves)
 - Importance of the cave system (past or present human uses, environmental importance, etc.)
 - Conservation methods at work in the park (what they are and why)
 - At least 6 interesting facts of choice
 - At least 3 images of the park (can be taken from magazines, brochures, the Internet, or other sources, or hand drawn)
3. Give students time in class and as a homework assignment to work on their research reports. The following Web sites have good information on the national parks, as well as images of these three cave systems:
 - <http://data2.itc.nps.gov/parksearch/atoz.cfm>
 - <http://www.hawaii.volcanoes.national-park.com/>
 - <http://www.carlsbad.caverns.national-park.com/>
 - <http://www.mammoth.cave.national-park.com/>
4. Once students have completed their reports, divide the class into groups of 3–5 students and have them share their reports with one another, making sure there is at least one report for each

park per group. Have students read their reports aloud to their groups and ask them to share the images they included in their reports.

5. After each student has had a chance to share their report with their group, ask them to talk about the similarities and differences between the three parks and their cave systems. How was each cave system formed? What are the different troglobites that live in each cave system? What is unique about each of the three cave systems? Ask for volunteers to share some of their group's thoughts and information with the rest of the class. Talk about the importance of these caves and the reasons why we need to protect them.

Assessment

Use the following three-point rubric to evaluate students' work during this lesson.

- **3 points:** Students were highly engaged in class discussions; produced a coherent, complete report, including all of the requested information; and demonstrated a clear understanding of the importance of adopting conservation measures to protect major cave systems.
- **2 points:** Students participated in class discussions; produced an adequate report, including most of the requested information; and demonstrated a basic understanding of the importance of adopting conservation measures to protect major cave systems.
- **1 point:** Students participated minimally in class discussions; created an incomplete report with little or none of the requested information; and were unable to demonstrate an understanding of the importance of adopting conservation measures to protect major cave systems.

Vocabulary

guano

Definition: A substance composed chiefly of the dung of sea birds or bats, accumulated along certain coastal areas or in caves

Context: In the early part of the 20th century bat guano was mined from Carlsbad Cavern caves and sold for use as fertilizer.

karst

Definition: An irregular limestone region with sinkholes, caves, underground streams, and springs

Context: Karst regions usually lack surface water because it's all underground.

petroglyph

Definition: Pictures, symbols, or other artwork pecked, carved or incised on natural rock surfaces

Context: The cave has preserved these 3,000-year-old petroglyphs but not their meaning.

subterranean

Definition: Existing or happening under the Earth's surface

Context: In these caves you'll find a subterranean world as uncharted as the surface of Mars.



stalactite

Definition: A tapering structure hanging from the roof of a cave, most often formed of calcite deposited by dripping water.

Context: Some of the largest stalactites have taken millions of years to form.

stalagmite

Definition: A tapering column rising from the floor of a cave, most often formed of calcite deposited by dripping water.

Context: Stalagmites often grow from the drips of calcite falling from the stalactite above.

troglobite

Definition: An animal that has adapted to living life permanently inside caves

Context: Since 1971 over 50 of these cave-adapted critters, or troglobites, have been identified in Hawaii.

vug

Definition: A small cavity in rock.

Context: A vug may be lined with a mineral that is different from the rock around it.

Academic Standards

National Academy of Sciences

The National Science Education Standards provide guidelines for teaching science as well as a coherent vision of what it means to be scientifically literate for students in grades K-12. To view the standards, visit this Web site:

<http://books.nap.edu/html/nses/html/overview.html#content>.

This lesson plan addresses the following national standards:

- Physical Science: Properties of objects and materials; Properties and changes of properties in matter; Motions and forces
- Life Science: Organisms and environments; Diversity and adaptations of organisms
- Earth and Space Science: Properties of earth materials; Structure of the earth system
- Science in Personal and Social Perspectives: Changes in environments, Populations, resources, and environments

Mid-continent Research for Education and Learning (McREL)

McREL's Content Knowledge: A Compendium of Standards and Benchmarks for K-12 Education addresses 14 content areas. To view the standards and benchmarks, visit

<http://www.mcrel.org/compendium/browse.asp>.

This lesson plan addresses the following national standards:



- Science: Physical Sciences—Understands the structure and properties of matter; Understands forces and motion
- Science: Earth and Space Sciences—Understands Earth's composition and structure
- Geography: Physical Systems – Knows the physical processes that shape patterns on Earth's surface
- Geography: Environment and Society – Understands how human actions modify the physical environment

The National Council for the Social Studies (NCSS)

NCSS has developed national guidelines for teaching social studies. To become a member of NCSS, or to view the standards online, go to <http://www.socialstudies.org/standards/strands/>.

This lesson plan addresses the following thematic standards:

- People, Places, and Environments
 - Science, Technology, and Society
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Support Materials

Develop custom worksheets, educational puzzles, online quizzes, and more with the free teaching tools offered on the Discoveryschool.com Web site. Create and print support materials, or save them to a Custom Classroom account for future use. To learn more, visit

- <http://school.discovery.com/teachingtools/teachingtools.html>
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DVD Content

This program is available in an interactive DVD format. The following information and activities are specific to the DVD version.

How To Use the DVD

The DVD starting screen has the following options:

Play Video – This plays the video from start to finish. There are no programmed stops, except by using a remote control. With a computer, depending on the particular software player, a pause button is included with the other video controls.

Video Index – Here the video is divided into five parts (see below), indicated by video thumbnail icons. Watching all parts in sequence is similar to watching the video from start to finish. Brief descriptions and total running times are noted for each part. To play a particular segment, press Enter on the remote for TV playback; on a computer, click once to highlight a thumbnail and read the accompanying text description and click again to start the video.



Curriculum Units – These are specially edited video segments pulled from different sections of the video (see below). These nonlinear segments align with key ideas in the unit of instruction. They include onscreen pre- and post-viewing questions, reproduced below in this Teacher's Guide. Total running times for these segments are noted. To play a particular segment, press Enter on the TV remote or click once on the Curriculum Unit title on a computer.

Standards Link – Selecting this option displays a single screen that lists the national academic standards the video addresses.

Teacher Resources – This screen gives the technical support number and Web site address.

Video Index

Segment 1: Mammoth Cave

Description:

Explore the cave system that stretches beneath central Kentucky for more than 360 miles, and learn how water, air, and earth combine to create this underground wonder.

Pre-viewing question:

Q: Have you ever explored a cave?

A: Answers will vary.

Post-viewing question:

Q: How are carbonic solution caves formed?

A: As water passes through the air and ground it picks up carbon dioxide. This creates a weak carbonic acid solution that works its way through cracks in limestone, slowly dissolving the rock.

Segment 2: Hot Lava, Cool Caves

Description:

You can find the world's biggest and most active volcanoes at Hawaii Volcanoes National Park. And underground, you can also find caves created by rivers of molten rock.

Pre-viewing question:

Q: What is lava?

A: When magma, or molten rock, from deep within the Earth's interior reaches the surface through volcanic activity or through a fissure, it is called lava.

Post-viewing question:

Q: How do volcanic eruptions create lava tubes?

A: As the red-hot lava flows down the side of the volcano, the portion that touches air cools and hardens, creating a chamber through which the rest of the lava flows. When the eruption stops, the lava drains out of the tube and leaves a hollow interior.

Segment 3: Life Underground

Description:

A lava tube might not seem like a great place to live, but scientists are discovering a number of organisms that have made homes for themselves there. Join scientists as they try to determine how these life forms evolved.



Pre-viewing question:

Q: What is a troglobite?

A: A creature adapted to live in a cave that cannot live outside it.

Post-viewing question:

Q: What is significant about the troglobites found in Hawaii's lava tubes?

A: The island of Hawaii was formed less than a million years ago, which means there hasn't been a lot of time for an organism species to adapt to living in total darkness. Scientists think the abundance of food in the lava tubes may have helped speed the troglobites' evolutionary processes.

Segment 4: Keeping Carlsbad Clean

Description:

An army of park rangers and volunteers work hard to keep Carlsbad Cavern clean. Find out why this task has an importance that goes beyond just getting ready for the next group of tourists.

Pre-viewing question:

Q: Why is it important to keep caves clean?

A: Answers will vary, but it's important for students to understand that even the smallest residue left by visitors can affect the rock formation in the cave.

Post-viewing question:

Q: Why are scientists conducting tests on some of the water in the Carlsbad caves?

A: They want to see if humans have affected the water in any way, which might also affect the types of bacteria and other organisms there.

Segment 5: Cave Creation

Description:

Carlsbad Cavern was formed by different acid solutions coming from above and below it. Find out how that happened and visit the Cavern's resident bat population.

Pre-viewing question:

Q: What is the difference between a stalactite and a stalagmite?

A: Both are made of calcium carbonate. Stalactites grow down from the ceiling, while stalagmites rise from the floor. (Here's an easy way to remember: stalactite = "c" for ceiling; stalagmite="g" for ground.)

Post-viewing question:

Q: How were the caves in Carlsbad Cavern formed?

A: Hydrogen sulfide gas rose from petroleum deposits deep in the ground to mix with water, creating sulfuric acid. This substance dissolves rock much faster than carbonic acid.

