

The History and Science of Marvel Cave

Geologically speaking, the Ozarks is a karst region, land characterized by extensive underground caverns that develop as limestone dissolves by contact with water. Caves begin to form when rainwater seeps into soil, absorbing a small amount of carbon dioxide. Water mixed with carbon dioxide forms a weak carbonic acid solution which dissolves rock (particularly dolomite or limestone). Water flow creates and enlarges underground passages, then often surfaces at a spring. As the flow of water continues to erode deeper into the surface, the openings left behind become caves.

On Roark Mountain, the Silver Dollar City theme park was literally built around the entrance to Marvel Cave, upon the foundations of a genuine 1880's mining town called Marmaros (Greek for marble). Marvel Cave has been designated a Registered Natural Landmark by the U.S. Department of the Interior – National Park Service because it possesses exceptional value in illustrating the natural history of the United States. The cave has been cited for its outstanding effort in conservation attempts to preserve its rare and endangered colony of gray bats.

Ron Martin, a native of the Ozarks and a teacher, has been a guide and naturalist at Marvel Cave. In his book Jewel of the Ozarks, Marvel Cave he writes, "Marvel Cave with its Cathedral Room, the largest cave entrance room in America, is undeniably the Ozarks' greatest cave. It was first discovered by the Osage Indians around 1500 AD. Hearing strange noises coming from deep within the entrance pit, they named it the Devil's Den and never entered. In 1869, after the Ozarks became a part of the United States, the first white man entered the cave to look for valuable mineral deposits. In 1884, the Marble Cave Mining and Manufacturing Company was organized to remove any valuable deposits that could be found in the immense cave." Explorers expected to find their riches in marble, however none was found and they settled for mining the extensive quantities of bat guano that could be used in the production of gunpowder instead. **Hear these and other stories in colorful detail from your cave guide during the hour-long tour of Marvel Cave.**

The life of Marvel Cave has adapted to a unique environment of nearly constant temperatures, high humidity, a limited food supply, perpetual darkness and intense silence broken only by dripping water or the flutter of bat wings. Since green plants cannot grow in darkness, cave life is dependent on food energy being brought in. This is mostly accomplished by animals or surface water transporting nutrients into the cave.

Cave animals are classified into three groups. Animals that never complete their entire life cycle in a cave and enter mainly for hibernation or refuge are called troglonenes. Bats, bears, raccoons and man are in this subdivision. Animals that normally live in the dark zones of a cave, but can live outside the cave, are called trogloniles. These include cave crickets, some

salamanders and beetles. Troglobites live permanently in the dark zone. These include blind cave fish, cave snails, and the Ozark Blind Salamander.

Marvel Cave's Ozark Blind Salamanders brought recognition from scientific circles after their discovery. The prestigious journal Scientific American published accounts of the find in 1885, while the Smithsonian Institution proclaimed it to be the most important zoological finding in North America. The Ozarks Blind Cave Salamander is usually found in the Lost River Canyon of Marvel Cave, but is rarely seen by visitors. They are blind and lack pigmentation due to their dark environment. They range from 4-5 inches in length.

At one time, there were over 200,000 gray bats in Marvel Cave. Bats are not blind and do not try to fly into one's hair, as some people have believed in the past. At night and in the darkness of cave passages, bats navigate by echolocation. They emit high-pitched sounds, inaudible to humans, which echo from objects and are received by their sensitive hearing. The time required for the echo to return indicates the distance from the object to the bat. Bats are helpful to man. During spring, summer, and fall months they fly out of the cave in the early evening and devour flying insects. Each night when not in hibernation, a bat will consume enough insects to equal one-half its body weight.

The limestone and dolomite bedrock of the Ozarks' mountains contains the mineral calcite. Rainwater dissolves carbon dioxide found in the soil and air to form a weak acid solution called carbonic acid. As with the cave atmosphere, carbon dioxide is released from the solution, resulting in small deposits of crystallized calcite, forming a stalactite or other speleothems. Growth rates of speleothems can vary greatly – averaging from 25 to 100 years to form one inch. Contact with human hands can limit or arrest the growth of speleothems.

The world's underground altitude record was set in Marvel Cave's Cathedral Room on July 7, 1963. Don Piccard achieved the record only 4 months after he made the first successful crossing of the English Channel in a hot air balloon. This notable achievement was commemorated in 1987 and 1988 in Marvel Cave with the flight of two hot air balloons piloted by attorney Carson Elliff and professional balloon pilot Jim Herschend. Both were Marvel Cave guides during the 1970s.

Source: Jewel of the Ozarks, Marvel Cave by Ronald L. Martin

Knowledge Standards
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Knowledge Standards

Students will acquire a solid foundation, which includes the knowledge of:

Mathematics Knowledge Standards

- Addition, subtraction, multiplication and division; other number sense, including numeration and estimation; and the application of these operations and concepts in the workplace and other situations
- Geometric and spatial sense involving measurement (including length, area, and volume), trigonometry, and similarity and transformations of shapes
- Data analysis, probability and statistics

Science Knowledge Standards

- Properties and principles of matter and energy
- Properties and principles of force and motion
- Characteristics and interactions of living organisms
- Changes in ecosystems and interactions of organisms with their environments
- Processes (such as plate movement, water cycle, and air flow) and interaction of the Earth's biosphere, atmosphere, lithosphere and hydrosphere
- Impact of science, technology and human activity on resources and the environment

Social Studies Knowledge Standards

- Continuity and change in the history of Missouri, the United States and the world
- The major elements of geographical study and analysis (such as location, place, movement, regions) and their relationships to changes in society and environment
- The use of tools of social science inquiry (such as surveys, statistics, maps and documents)

Study Guide

Questions: The History and Science of Marvel Cave

1. What does water mixed with carbon dioxide form?
2. How does this element affect rock?
3. What geological term is used to describe land characterized by extensive underground caving?
4. Who originally discovered Marvel Cave?
5. What was the name of the original mining town, and what does it mean in the Greek language?
6. What was successfully mined from Marvel Cave, and how was it used?
7. Name the process witch bats use to navigate and describe it.
8. What are speleothems made of?
9. What will contact with human hands do to speleotherms?
10. Name two animals that live in Marvel Cave.

Answers:

1. Carbonic acid
2. Carbonic acid dissolves rock
3. Karst
4. Osage Indians
5. Marmaros, marble
6. Bat guano, gunpowder
7. Bats navigate by echolocation. This is the process of emitting high-pitched sounds, inaudible to humans, which echo from objects and are received by their sensitive hearing. The time required for the echo to return indicates the distance from the object to the bat.
8. Crystallized calcite
9. Limit or arrest their growth
10. Ozarks Blind Salamander and Gray Bats

Lesson Plan

Growing Crystals In The Classroom

Written by Trisha Haltom – Ava High School Science Lab

Rock Candy – Growing Crystals (Lab)

Part A – Shake out some sodium chloride crystals (table salt) onto a dark piece of paper. Look at the crystals with a magnifying glass. What is the shape of each sodium chloride crystal? Sketch the shape of the crystals. Some are large and some are small. Do the shapes differ?

Part B – Growing edible crystals – Begin by heating to boiling 250 ml of water in a beaker on a hot plate. Remove the beaker from the hot plate and stir sugar into the water until no more sugar will dissolve. What do you call a solution in which no more solute will dissolve? Pour your sugar solution into a glass. Take a piece of clean string and tie a large knot in the bottom of it. Wet the bottom two-thirds of the string and dip it in sugar. Tie the string around a pencil and hang it in the solution with the pencil going over to the top of the glass. Observe the string daily. Construct a data observation sheet to record daily observations of the string. When the crystals have grown, remove them from the glass and let them dry on a piece of waxed paper. Observe the crystals with a hand lens or microscope. Sketch the shape of your sugar crystals. Record all observations and data.

Class Response

I have completed this lab after the study of solutions. Since carbonic acid is the solution responsible for speleothem formations of crystal calcite, this lab focuses on the science behind the formations. Students actually see crystals form although they cannot see cave formation take shape.

The students in my freshman physical science class enjoyed this lab. They did, however, not like waiting for the crystals to form. They were able to put to use the vocabulary we had previously learned: solution, solvent, solute, saturation, etc., in a non-threatening lab atmosphere. Because the materials and procedures are so basic, the students actually run this lab on their own.

The inquiry lab method could be used in place of the procedures. The students would be given the materials and asked to hypothesize and write their own set of procedures to try to make crystals. The same observations would be recorded, but many of the lab sets would not make crystals. That, in itself, would be a learning experience.

Students could research different crystal formations, including speleothems before or after this lab when enriching the curriculum.

This is one of my favorite labs because it is easy to set up, and even though the concept is simple, the students still seem amazed the crystals actually grow.

Missouri State Knowledge/Performance Standards

Science 1 – Properties and principles of matter and energy

Goal 1.3 – Conduct lab investigations to study nature.

Goal 1.8 – Organize data, information and ideas into useful forms. Marvel Cave Study Guide.