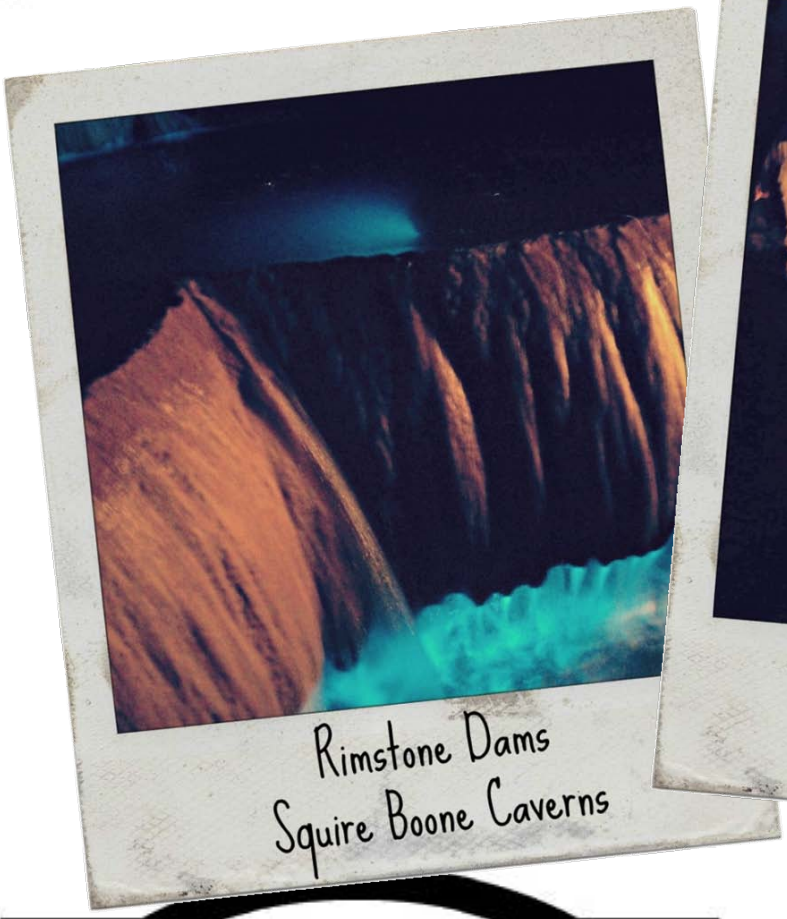
Squire Boone Caverns



Rimstone Dams
Squire Boone Caverns

Squire Boone Caverns
Mauckport, Indiana

PRESENTS

A comprehensive and interactive study plan provided to help promote general knowledge and understanding of caves and to prepare students for field observations and discussions at Squire Boone Caverns.

This unit plan includes:

- five lesson plans
- background information for the teacher and student
- BIG IDEAS lesson wrap-ups
- experiment ideas for each lesson
- field trip guides for each lesson
- lesson assessments

Lesson 1

CAVE OR CAVERN?

OBJECTIVE

Students will be able to distinguish between caves and caverns.
Students will be able to identify the different types of caves.

Background Information

Is there a difference between a cave and a cavern?

This is a common question, and most people use the terms interchangeably. However, it is important to note that there is a difference. A **cave** is **any cavity in the ground that is large enough that some portion of it will not receive direct sunlight**. The necessity of a human being able to enter is also often used to define a cave. A **cavern**, on the other hand, can be defined two ways: as **a series of connected underground caves**, or as **a specific type of cave, formed naturally in soluble rock, with the ability to grow speleothems**. Using these definitions, we can say that all caverns are caves, but not all caves are caverns.

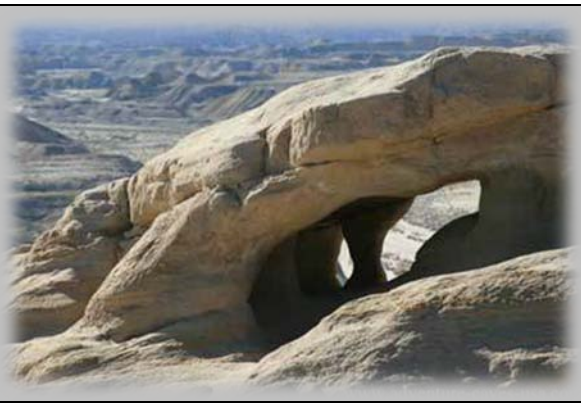
Caves

Caves are classified into two main categories: primary and secondary. A **primary cave** is **a cave that develops as its host rock (the rock in which the cave is formed) is solidifying.** Lava tubes are one such primary cave (more information to follow). A **secondary cave** is **a cave that is carved out of the host rock, which already exists**. Sea caves are one such example. The majority of caves fall under this second category.

Speleogenesis is **the formation and development of caves.** On the next page, you will find the different categories of caves and how they are formed.

<u>Coral Caves</u> (primary) – formed when colonies of coral grow together, creating walls around an empty space. When coral caves are exposed by changing sea levels, they are often enlarged or even destroyed by waves and wind erosion.

<u>Eolian (Wind) Caves</u> (secondary) – formed when wind erodes away weak areas in sandstone cliffs.



<u>Glacier Caves</u> (secondary) –formed when water from the surface of the melting glacier trickles down through crevices in the glacier to the bedrock on which the glacier rests. Long tunnels are formed as the water melts the ice in the base of the glacier. These are highly unstable caves.

<u>Ice Caves</u> (secondary) – formed when water or wind carve out glaciers or snowfields. It should be noted a second type of ice cave is actually a rock cavity that contains ice formations inside that look similar to the calcite formations of solutional caves.

<u>Sea Caves</u> (secondary) – formed when waves erode away the weak areas of sea cliffs.

<u>Solutional Caves</u> (secondary) –this is the type of cave that is classified as a cavern. They are formed by the dissolution of soluble rocks. The common example, and the one referenced throughout this lesson, is limestone.

<u>Tectonic Caves</u> (secondary) – formed by tectonic force, or the movements of the plates of the earth's crust. Tectonic caves include any caves formed by a geological force that causes rocks to move apart. Talus caves (formed by rock slides and collapses) are one example of tectonic caves.

<u>Volcanic Caves</u> (primary) – various forms of volcanic caves are created from flowing lava and volcanic gas. Examples include lava tubes and blister caves.

The Creation of Solutional Caves/Caverns

Solutional caves are the most frequently occurring caves. As previously stated, solutional caves are found in soluble rock. Though common knowledge suggests that limestone caverns such as Squire Boone Caverns are formed by flowing water, it is important to note that it is not simply water that dissolves the limestone. If a piece of limestone was placed in a cup of water, very little of the limestone would dissolve. Instead, the creation of a solutional cave is due to the presence of a natural acid.

In the case of Squire Boone Caverns and other limestone caverns found in the Midwest, it is likely that **carbonic acid** is the cause of dissolution. As rainwater seeps through the soil, it will come in contact with carbon dioxide, found in the soil from decaying plant and animal matter. This creates **H_2CO_3** (carbonic acid), which is commonly known as carbonated water. This weak acid, the same that gives soft drinks their fizz, is capable of dissolving limestone, creating fissures that ultimately expand into passageways and rooms.

Carbonic acid is also responsible for the creation of **speleothems**, or cavern formations. This will be further discussed in Lesson 2.

BIG IDEAS

Lesson 1: Cave or Cavern?

***There is a difference between a cave and a cavern.**

***All caverns are caves, but not all caves are caverns.**

***Not all caves are made of rocks. Some are made of ice, some form from molten lava, and some are made of coral.**

***The only type of cave that is also considered a cavern is a solutional cave.**

***Squire Boone Caverns is a limestone solutional cave. Carbonic acid dissolved the limestone to create this cave.**

Lesson 1: Cave or Cavern?
Experiment Idea

(For the Teacher)

Part One
Dissolving Limestone: A Closer Look

Materials

- White vinegar
- Eye droppers
- Shallow pan
- 5 rock samples (Important Note: One of your rock samples should be limestone, but the others should be non-soluble rocks)

Procedure

- Explain that rocks and minerals are often identified by their physical properties. Some physical properties used to identify rocks and minerals include color, luster, texture, hardness, cleavage, and weight. One physical property that is often used is solubility – can the rock or mineral be dissolved?
- Examine each of your rock samples and discuss the obvious physical properties of each. Students should fill in the chart on the See For Yourself! Lesson 1 worksheet. Discuss that some properties (such as solubility) can't be discovered at a glance and require experimentation.
- Explain that white vinegar is a stronger acid than carbonic acid, meaning that it will dissolve a soluble rock more quickly and will make the process visible.
- Place the rock samples in the shallow pan. Using the eye dropper, coat each rock sample with vinegar. Explain that rocks that bubble are soluble rocks. Have students mark their charts so they can see which rocks are soluble and which aren't. The limestone piece will bubble as it dissolves, while the other rocks will not.
- Ask students to tell you which rock sample is the limestone. After they tell you, they should add the rock names to their charts.

Part Two
Dissolving Limestone: The Big Picture

Materials

- Sugar cubes
- A clear fish tank (square or rectangle)
- Toothpicks
- 1 spray bottle of warm water
- Modeling clay

Procedure

- This experiment requires some prep work. Stack the sugar cubes against the inside of the fish tank. Ideally, the more sugar cubes, the better. The sugar cubes should be stacked at varying heights and depths for a more realistic look.
- Cover the sugar structure with a layer of clay. Make sure there are no gaps. This modeling clay will represent the soil layers above the limestone. Using a toothpick, poke several holes through the clay. Allow the clay to air dry.
- Explain to students that the sugar cubes represent large areas of limestone in the earth and the spaces between the cubes represent natural crevices in the limestone through which water travels. Spray the clay heavily with water. Explain that this represents rainwater. The water will seep through the clay and slowly dissolve the sugar cubes.
- After the experiment, students should fill out the Venn Diagram on the See For Yourself! Lesson 1 worksheet.

Lesson 1: Cave or Cavern? Experiment Idea

See For YOURSELF!

Name: _____

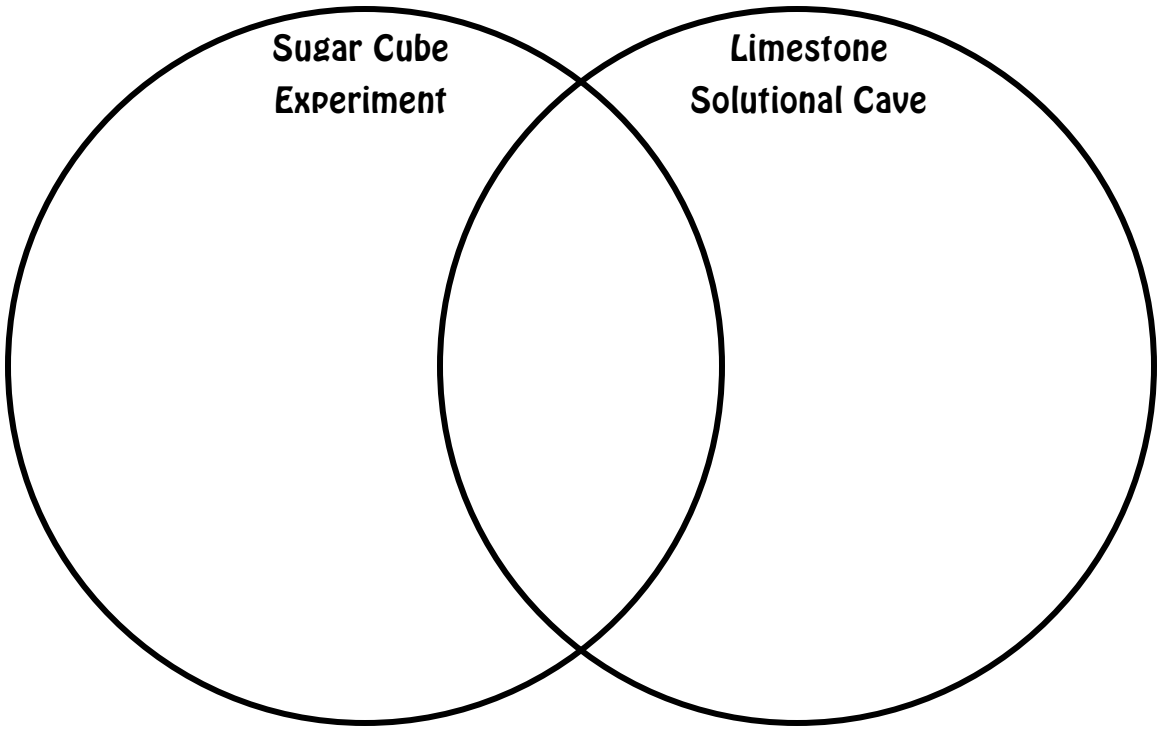
Part One

Dissolving Limestone: A Closer Look

What COLOR is it?	What does it feel like? (TEXTURE)	Is it shiny? (LUSTER)	Is it SOLUBLE?	Rock Name

Part Two

Dissolving Limestone: The Big Picture



Name: _____

Field Trip Date: _____

School: _____

Learning UNDERGROUND

Squire Boone Caverns Field Trip Guide

Lesson 1: Cave or Cavern?

DIRECTIONS: Answer each of the following questions either during or after your cavern tour at Squire Boone Caverns. If your tour guide doesn't say the answer during the cave tour, don't forget to ask!

1. What type of cave is Squire Boone Caverns?
A. ice cave
B. solutional cave
C. sea cave
D. lava tube

2. What is Squire Boone Caverns' host rock?
A. salt
B. sandstone
C. marble
D. limestone

3. What type of acid made Squire Boone Caverns?
A. carbonic acid
B. sulfuric acid
C. vinegar
D. no acid, just water

4. Where does the acid come from?
A. gas underground
B. rainwater
C. the waterfalls in the cave
D. people pour it into the cave

5. How do we know that Squire Boone Caverns is a cavern?
A. There is no natural light.
B. It is a solutional cave, which means it is a cavern.
C. It is an underground room created by nature.
D. All of the above.

Lesson 1

CAVE OR CAVERN?

OBJECTIVE

Students will be able to distinguish between caves and caverns.
Students will be able to identify the different types of caves.

DIRECTIONS: Match the type of cave to the description.

1. Coral Cave	**A. ice formations grow inside of a rock cavity**
2. Wind Cave	**B. formed when soluble rock is dissolved by an acid**
3. Glacier Cave	**C. created by flowing lava and volcanic gas**
4. Ice Cave	**D. a hollow passage is created at the base of the glacier**
5. Sea Cave	**E. form when coral colonies grow together around an empty space**
6. Solutional Cave	**F. created by the movements of the tectonic plates**
7. Tectonics Cave	**G. wind erodes away weak areas in sandstone cliffs**
8. Volcanic Cave	**H. waves erode away weak areas in sea cliffs**

DIRECTIONS: Answer each question in 2 or 3 complete sentences.

9. List three ways you can identify a cavern.

_____

_____

_____

10. Is Squire Boone Caverns a cave, a cavern, or both? Give two reasons to support your answer.

_____

_____

Lesson 2

The Creation of Speleothems

OBJECTIVE

Students will be able to explain the process by which speleothems grow.

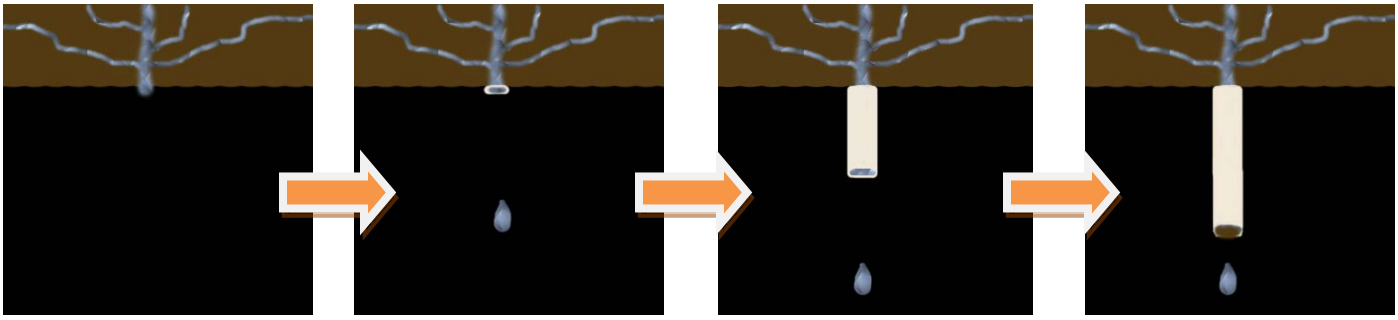
Background Information

What is a speleothem?

Geologists refer to **the formations found in solutional caves (caverns)** as **speleothems.** This comes from the Greek words "spelaion" meaning cave and "thema" meaning deposit. Speleothems are formed by minerals that are picked up from the cavern's host rock and deposited by dripping water. The type of host rock will determine the mineral makeup of the speleothems. For the purpose of this lesson, we will focus on the most common solutional cave – a limestone solutional cave.

How do speleothems form?

In Lesson 1 we discussed the creation of caverns by means of carbonic acid. It is important to note that, as the carbonic acid makes its way through the limestone, dissolving the limestone as it goes, the water picks up the dissolved limestone (**calcium carbonate**). When the water reaches the open air of the cave, it releases both the carbon dioxide and the calcium carbonate. When the calcium carbonate leaves the solution, it crystallizes into a **calcite** deposit. Sometimes, the water won't release all of the calcium carbonate, but when the water droplet hits the floor, it releases the leftover minerals. Water continues to drip from the same place, depositing more and more calcite. These deposits build up to create speleothems. The dripping water in the cave will create speleothems on the cavern ceilings, walls, and floors. We will learn about the different types of speleothems in Lesson 3.



This diagram shows the process by which a soda straw (one type of speleothem) grows.

BIG IDEAS

Lesson 2: The Creation of Speleothems

*The word "speleothem" comes from the Greek words "spelaion" and "thema"

*A "speleothem" is a cavern formation created by mineral deposits.

*Carbonic acid dissolves cavern passages and creates speleothems

*The primary mineral that makes the formations in a limestone cavern is calcite.

Lesson 2: The Creation of Speleothems Experiment Idea

(For the Teacher)

Grow Your Own Formation

Materials

- 2 pieces of 12-inch cotton string or yarn or 2 strips of cotton fabric
- 4 jars of the same size
- 2 saucers
- Epsom Salts
- Baking soda
- Warm water in a pitcher
- Food coloring (optional)
- Student worksheet, included

Procedure

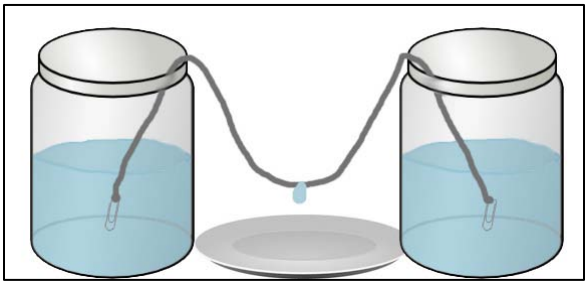
- Explain that this experiment will show how water can deposit minerals, as discussed in Lesson 2. Students should also understand that normally this process takes thousands of years in a cavern, but the use of salt-based chemical compounds and the sun for evaporation will make this process go much faster.
- Dissolve as much of the Epsom Salts as you can in a pitcher of very warm water. Arrange two jars in a windowsill with a saucer between them. Fill each jar about halfway with the highly saturated Epsom Salt solution.
- Tie a weight (such as a paperclip) to each end of a piece of yarn or strip of fabric. Completely soak the yarn/fabric in the solution before placing the yarn so that each end is well inside the water solution in each jar. The middle of the yarn should be suspended over the saucer and should hang lower than the water levels inside the jar.
- Put just a touch of Epsom Salts in the saucer.
- Set up the second set of jars the same way as you did the first set, except you should substitute the Epsom Salts with the baking soda.
- Label one set of jars A and the second set B. If you want, add a different color drop of food coloring to each solution when mixing.
- Leave the jars for several days. The Epson Salts solution will wick along the yarn/fabric strip then drip off the low point of the yarn onto the saucer. Deposits should build up on both the yarn and the saucer and may eventually form a “column.” The baking soda solution will create a very different formation.

Lesson 2: The Creation of Speleothems Experiment Idea

See For YOURSELF!

Name: _____

Grow Your Own Formation



Directions: Write down your daily observations of this experiment. Observations may include **length**, **color**, **formation**, etc.

DAY 1

EPSOM SALTS _____

BAKING SODA _____

DAY 2

EPSOM SALTS _____

BAKING SODA _____

DAY 3

EPSOM SALTS _____

BAKING SODA _____

DAY 4

EPSOM SALTS _____

BAKING SODA _____

DAY 5

EPSOM SALTS _____

BAKING SODA _____

Name: _____

Field Trip Date: _____

School: _____

Learning UNDERGROUND

Squire Boone Caverns Field Trip Guide

Lesson 2: The Creation of Speleothems

DIRECTIONS: Answer each of the following questions either during or after your cavern tour at Squire Boone Caverns. If your tour guide doesn't say the answer during the cave tour, don't forget to ask!

1. What is the term geologists use for cavern formations?
A. icicles
B. decorations
C. speleothems
D. spelunker

2. What is the name of the white mineral that makes most of the cavern formations?
A. birnessite
B. calcite
C. goethite
D. pyrite

3. What is the average growth rate for a speleothem?
A. 1 cubic inch every 100 years
B. 1cenimeter every 1000 years
C. 1 foot every year
D. 6 inches every three years

4. When the water drips in the cave, what gas is released?
A. carbon dioxide
B. oxygen
C. hydrogen
D. helium

5. True or False: Breakdown in caves is a type of speleothem.
A. False
B. True

Lesson 2

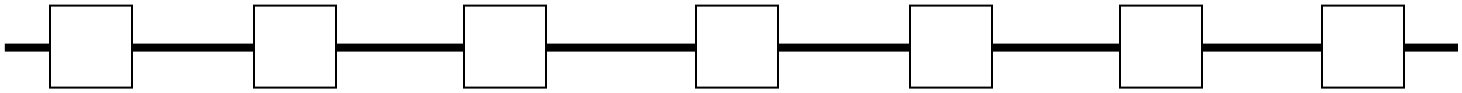
The Creation of Speleothems

OBJECTIVE

Students will be able to explain the process by which speleothems grow.

DIRECTIONS: Below is a list of events. Most of these events are part of how a speleothem grows, but some are not. Put the chain of events in order from beginning to end. Write the letter of the event in the box on the timeline.

BEGINNING **END**



A. Carbonic acid picks up dissolved limestone (calcium carbonate).

B. The sun dissolves the water, leaving calcite behind on the cave ceiling.

C. It rains outside.

D. Carbonic acid hits the open air of the cave, releasing the carbon dioxide gas.

E. Carbonic acid picks up gypsum from the limestone.

F. Rainwater picks up carbon dioxide in the soil, becoming carbonic acid.

G. The water releases the minerals (calcite) on the ceiling of the cave.

H. Carbonic acid seeps into the limestone.

I. Water deposits mud on the cave ceiling, creating speleothems.

J. The water releases the minerals (calcite) on the floor of the cave.

Lesson 3

All Sorts of Speleothems

OBJECTIVE

Students will be able to identify many different types of speleothems.
Students will be able to compare and contrast the different types of speleothems.

Background Information

Speleothems in Detail

Recall from Lesson 2 that the water entering the cave is what deposits minerals to create speleothems, or cavern formations. This water is not confined to just the ceiling of the cavern or to just one location in the cavern. Instead, water drips from all different areas of the caverns, which means that speleothems can grow on the ceilings, the floors, the walls, even on top of other speleothems! The amount of water and its location in the caverns often determines what the speleothems will look like. Take a look at the next page to see some of the most common forms of speleothems and a brief description of how they are created.

Soda Straw (Tubular Stalactite) – formed when the water first enters the cave and the calcite crystallizes around the water droplet, forming a ring. Each water droplet enters through the center of the ring and more rings stack on top of each other, making this hollow speleothem. When the tip of the soda straw gets clogged, water runs down the sides to create a stalactite.

Stalactite – formed when water droplets trail down the sides of a "dead" soda straw. The water deposits trails of minerals along the sides and at the tip, creating the typical conical shape of a stalactite.

Stalagmite – formed by water droplets hitting the floor and depositing the remainder of the minerals. Stalagmites are often found growing beneath stalactites. They tend to grow slower than stalactites and have rounded tops.

Column – formed when a stalactite and stalagmite meet each other so that the ceiling and the floor are connected.

Draperies (Cave Bacon) – formed on a sloped surface (like a wall) rather than a flat surface (like a ceiling). Water droplets trickle down the side of a sloped surface, leaving a trail of minerals behind. Water droplets follow this same path over and over again, building up the trail of calcite until it sticks out and hangs down.

Flowstone – formed by large amounts of water flowing in one area over a long period of time. Water flowing over a large surface area left behind sheets of minerals. Flowstone often indicates that a waterfall was once present. Flowstone forms faster than any other cavern formation.

Rimstone Dams – formed in a stream bed. Streams running through caverns contain calcite and other minerals. If there is a bump in the floor of the streambed, the water will deposit minerals on the bump. The bump will continue to grow until it creates a wall that dams up the stream. Water pools behind the wall before flowing over the edge.

Cave Popcorn (Coralloids) – formed by precipitation, these small speleothems often form when water seeps out of the wall of a cave or even out of existing speleothems, leaving behind little calcite nodules.

BIG IDEAS

Lesson 3: All Sorts of Speleothems

*Speleothems come in all shapes and sizes

*Soda straws are the "first" speleothem to grow in a cave

*Soda straws are some of the slowest growing speleothems; flowstone grows the fastest

*Soda straws, stalactites, stalagmites, columns, draperies, flowstone, rimstone dams, and popcorn are commonly found speleothems.

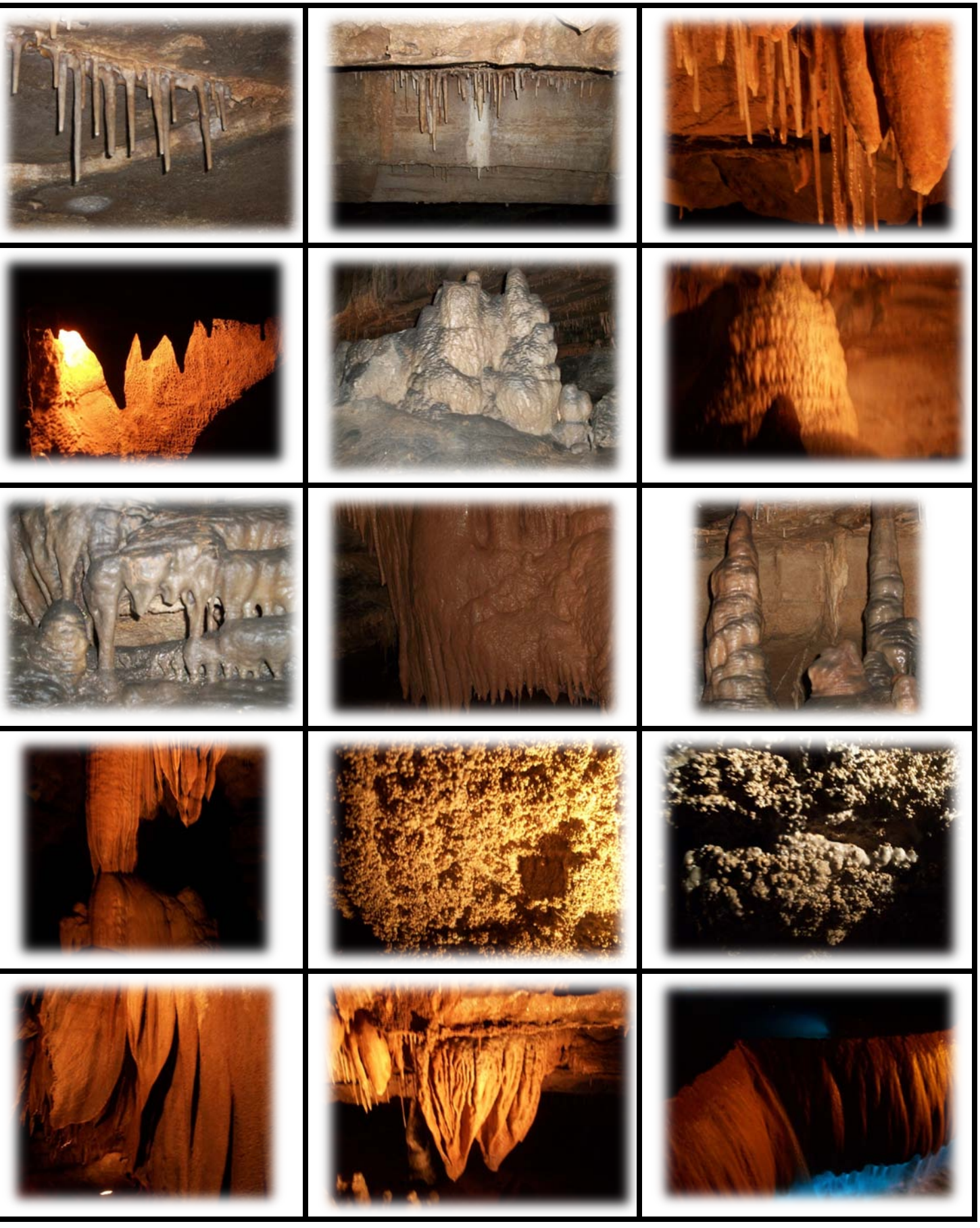
Lesson 3: All Sorts of Speleothems Activity Idea

(For the Teacher)

Speleothem Cards

On the next page, you can find pictures of the different cavern formations. Try using these cards to:

- Play a game of Speleothems Memory. Print two copies of the cards and paste them on index cards (one per card, leaving one side blank). Shuffle the cards and place them face down on a flat surface. Students have to find the matching card and say the name of the speleothem on the matching cards. For an extra challenge, have students match two different pictures of stalactites, stalagmites, etc.
- Create fact flash cards. Paste a picture on one side of an index card and, on the other, write a bulleted list of facts about that speleothem.
- Create a bulletin board of speleothems.
- Give each student a picture and have the students find the speleothem on their field trip.



Name: _____

Field Trip Date: _____

School: _____

Learning UNDERGROUND

Squire Boone Caverns Field Trip Guide

Lesson 3: All Sorts of Speleothems

DIRECTIONS: Answer each of the following questions either during or after your cavern tour at Squire Boone Caverns. If your tour guide doesn't say the answer during the cave tour, don't forget to ask!

1. Which of the following speleothems is formed by a waterfall?
A. stalactites
B. stalagmites
C. popcorn
D. flowstone

2. Which formation is the largest in Squire Boone Caverns?
A. the Fried Egg
B. the Rimstone Dams
C. the Rock of Ages
D. the Squire Boone

3. Squire Boone Caverns has the largest active _____ in a commercial cave in the U.S.
A. rimstone dams
B. soda straws
C. column
D. flowstone

4. Which of the following limestone cavern speleothems is *not* found in Squire Boone Caverns?
A. cave pearls
B. shields
C. rimstone dams
D. helictites

5. The Rock of Ages is a/an:
A. column
B. waterfall
C. cave popcorn
D. stalagmite

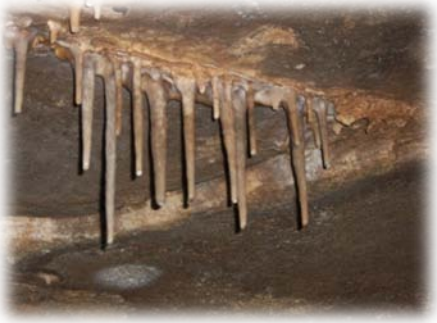
Lesson 3

All Sorts of Speleothems

OBJECTIVE

Students will be able to identify many different types of speleothems.
Students will be able to compare and contrast the different types of speleothems.

DIRECTIONS: Beneath each picture, write down all of the speleothems you can see in each picture.



Lesson 4 LIFE UNDERGROUND

OBJECTIVE

Students will be able to explain the three zones of a cavern system.
Students will be able to describe the different categories of cavern life and identify the types of animals for each category.
Students will be able to explain how the categories directly relate to the three zones of a cavern system.

Background Information

What are the three zones of a cavern system?

Caverns provide very unique living conditions for many plants and animals. The most prominent of these conditions is the darkness. This plays an important role in how animals adapt to a cave environment. If a cavern system is large enough, it can be divided into **three zones**. Each zone is **based on the level of light it receives**. The **first zone** is called the **Entrance Zone** and is **the area at the cavern opening**. The **second zone** is the **Twilight Zone**. **This area starts at the end of the entrance zone and continues on until all light is gone**, leading to the **third zone**: the **Dark Zone**. The **Dark Zone** is **the rest of the cavern that never sees light**.

Troglofauna – The Cave-Dwelling Animals

Troglofauna are **small, cave-dwelling animals that have adapted to their dark surroundings.** Some troglofauna live permanently underground and cannot survive outside of the cavern environment, while others are less-permanent residents. These cave-dwellers have adapted to the unique challenges of a cavern environment. They often have a heightened sense of hearing, touch, and smell, while their under-used senses, such as sight, tend to be lost.

Troglofauna are divided into three categories: troglobites, troglophiles, and trogloxenes.

Troglobites (“cave life”) – animals that live entirely in the dark parts of caves. These animals have adapted to life in total darkness and may not have eyes or skin pigmentation. They cannot survive outside of a cave environment.

CRAZY FACT: These creatures are not albino. Albinism is a congenital disorder. This is a common mistake.

EXAMPLES: Species of cave fish, cave crickets, shrimp, crayfish, and insects.

Troglophiles (“cave lover”) – cave-dwelling animals that may complete their life cycles within the cave, but they can also survive in above ground habitats.

CRAZY FACT: They actually prefer cave life and often only leave to find food.

EXAMPLES: Beetles, worms, crickets, and salamanders

Trogloxenes (“cave guest”) – animals that come and go from the cave, using it primarily as shelter.

CRAZY FACT: Most trogloxenes live in caves during certain periods in their life cycles, such as nesting or hibernation.

EXAMPLES: Bats, bears, mice, cave swallows, raccoons, and humans.

BIG IDEAS

Lesson 4: Life Underground

*Cavern systems are divided into three zones: the Entrance Zone, the Twilight Zone, and the Dark Zone.

*The zone is determined by the amount of light within.

*Cave-dwelling animals are called troglofauna. There are three types of troglofauna: troglobites, troglophiles, and trogloxenes.

*Troglobite means "cave life" and these animals only live in caves. They usually live in the Dark Zone.

*Troglophile means "cave lover" and these animals choose to live in the cave, although they can also live above ground. They usually live in the Twilight Zone.

*Trogloxene means "cave guest" and these animals only use the cave for shelter; they cannot live their whole lives within a cave. They usually live in the Entrance Zone, but some of them (like bats) can live in the Twilight Zone.

Lesson 4: Life Underground Experiment Idea

(For the Teacher)

Troglobite for a Day: Getting a Sense of Life in the Dark

Materials

- Variety of objects for touch experiment (feathers, water, sand, etc.) (5 objects minimum)
- Variety of foods for taste experiment (pieces of fruit, bread, candy, etc.) (5 foods minimum)
- Variety of containers of strong-smelling foods (garlic, onion, coffee, etc.) (5 smells minimum)
- Student worksheet, included (one per group)
- Blindfolds (one per group)

Procedure

- Begin by reviewing the three zones of a cavern and the three categories of troglofauna. In particular, emphasize what life would be like in the dark zone and how troglobites have adapted.
- Divide students into groups of four (one for each sense).
- Share with students that they are going to be troglobites for this activity and that, for each part of the experiment, one member of each group will be blindfolded. Either assign each member of the group a sensory experiment or let them choose. Give each group a copy of the worksheet and have them fill in the names of their group members. Distribute blindfolds to each group at this time.
- Blindfold the student in each group who will do the touch experiment. Allow the student to touch each item. The student should describe the sensation to their group and make a guess as to what they are touching. The group members should record the student's response as well as what the item actually is.
- For the hearing experiment, blindfold the students who are assigned this experiment. You can then either have each group make normal, everyday sounds or you can do it for the whole class (closing the door, crumpling paper, typing on a keyboard, etc.). Blindfolded students should guess the sound and, as they did with the touch experiment, students in the group should record the responses and the real sound.
- For the taste experiment, allow the blindfolded students to taste five different foods and attempt to identify them. If possible, put the food on toothpicks or spoons so they student won't be able to identity them by touching. Record responses.
- For the smell experiment, allow blindfolded students to smell the five strong-smelling foods and attempt to identify them. Record responses.
- Once all four sensory experiments have been completed, have a large-group discussion about heightened senses and how troglobites survive in the dark.

Lesson 4: Life Underground Experiment Idea

Names: _____

Troglobite for a Day: Getting a Sense of Life in the Dark

	TOUCH	HEARING	TASTE	SMELL
NAMES →				
ITEM 1: WHAT DID THEY GUESS?				
ITEM 1: WHAT IS IT REALLY?				
ITEM 2: GUESS				
ITEM 2: REALLY				
ITEM 3: GUESS				
ITEM 3: REALLY				
ITEM 4: GUESS				
ITEM 4: REALLY				
ITEM 5: GUESS				
ITEM 5: REALLY				

Name: _____

Field Trip Date: _____

School: _____

Learning UNDERGROUND
Squire Boone Caverns
Field Trip Guide

Lesson 4: Life Underground

DIRECTIONS: Answer each of the following questions either during or after your cavern tour at Squire Boone Caverns. If your tour guide doesn't say the answer during the cave tour, don't forget to ask!

1. In which zone of the cave does most of the cave tour take place?
A. Entrance Zone
B. Twilight Zone
C. Dark Zone
D. Ozone

2. Which is <u>not</u> a trogloxene that can be found in Squire Boone Caverns?
A. bats
B. bears
C. mice
D. humans

3. Which of these troglobites can be found in Squire Boone Caverns?
A. cave crayfish
B. shrimp
C. cave fish
D. albino bugs

4. In which zone of the cave do troglobites live?
A. Entrance Zone
B. Twilight Zone
C. Dark Zone
D. All three zones

5. Which sense do the cave crayfish <u>not</u> have?
A. Touch
B. Taste
C. Hearing
D. Sight

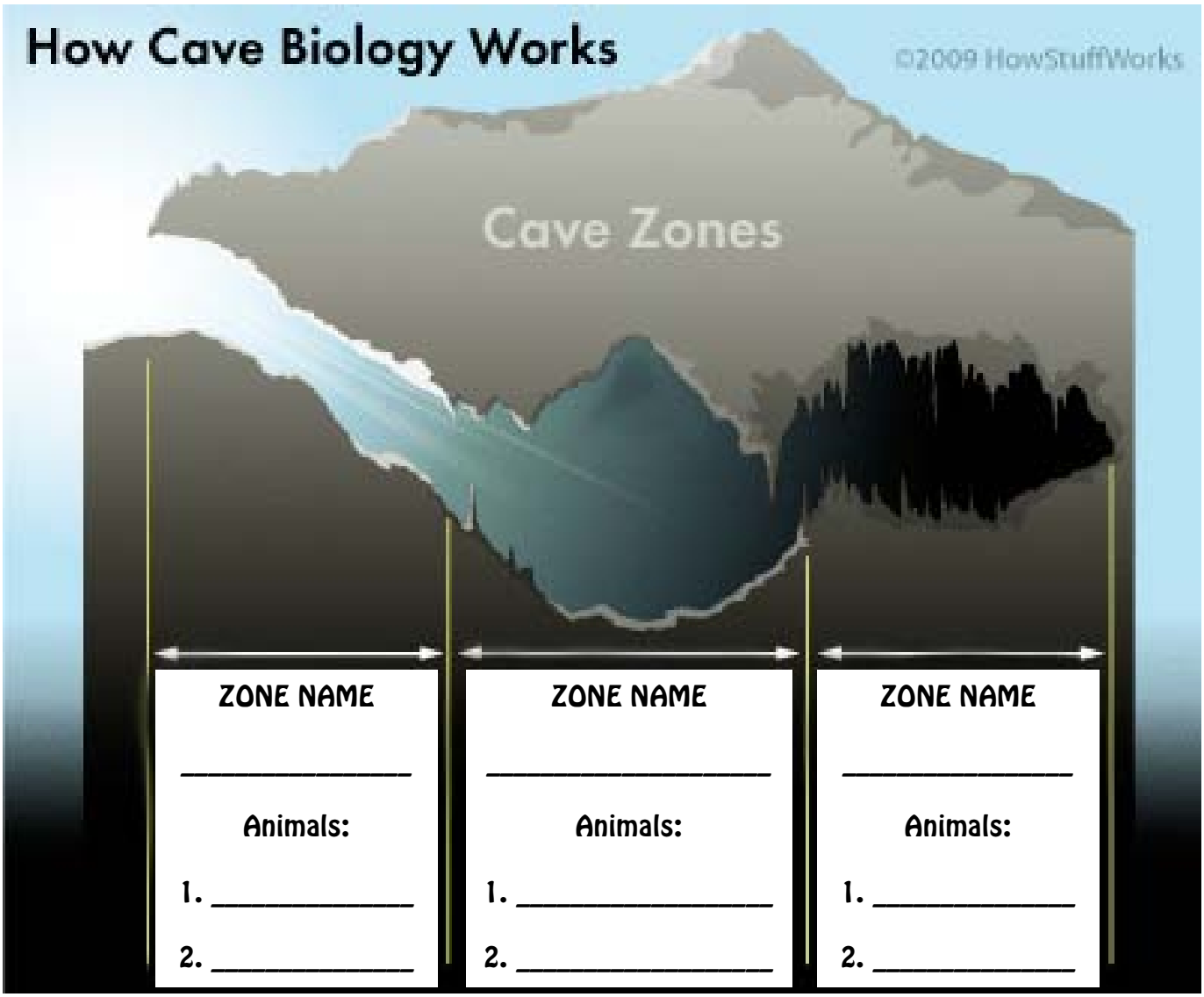
Lesson 4

LIFE UNDERGROUND

OBJECTIVE

Students will be able to explain the three zones of a cavern system.
Students will be able to describe the different categories of cavern life and identify the types of animals for each category.
Students will be able to explain how the categories directly relate to the three zones of a cavern system.

DIRECTIONS: Identify each zone of a cavern on the picture below. Then, write the names of two animals that live in each zone.



Lesson 5 People and Caverns

OBJECTIVE

Students will be able to explain the diverse uses of caverns in both the past and the present.
Students will be able to identify ways cavern environments can be destroyed.
Students will be able to explain the importance of cavern conservation and how caverns can be protected while still being enjoyed by people.

Background Information

Human Use of Caves

Caves were an obvious **natural shelter** for prehistoric man and their use dates back anywhere between **ten thousand years ago and two million years ago**. Evidence including bones, textiles, baskets, and charcoal can be found in caves, along with other indications of human dwelling, such as scorch marks from fire and cave drawings. **Caves were also used for religious and ceremonial purposes**. Some of the oldest Buddhist temples and shrines are located in caves in China and are still used today, while other **caves have been used as burial caves**. Squire Boone Caverns is the final resting place of Squire Boone Jr. and his original burial cave can still be visited today. Our ancient ancestors also knew that **caves were a great source of many natural resources** and, therefore, **many caves were mined for their rocks and minerals**. In more recent history, many caves were mined for bat guano, which is both an excellent fertilizer and a source material for gunpowder.

The **United States government** has used many caves for **storage purposes**, **military transportation**, or even for **protection**. Some caverns have even been stocked with food rations and water supplies in the event of a nuclear war.

In the United States today, **caves are mainly used by researchers and recreational cavers**, but in other parts of the world they are still being used as they were millions of years ago – as a home. Humans are, after all, **trogloxenes**.

Our Negative Impact

Humans often have a **negative impact** on cavern environments, often without knowing it. Some examples of our negative impact include the following.

- Improper development and inappropriate construction in order to commercialize a cave can be permanently damaging. Expanded entrances, elevator shafts, and gates change the cave's natural air flow. Gates impede the daily passage of animals, such as bats, in and out of the cave, often endangering them.
- Water pollution has a direct impact on cave life. Cave-dwelling animals rely on underground water, but increased human activity on the surface affects the water below. Excessive contamination can result from landfills, toxic waste dumps, septic tanks, underground gasoline storage tanks, pesticides, and toxic chemical spills.
- Illegal access to caves has resulted in the destruction of cave resources. Vandals steal or deface unique speleothems. Even legal recreational visitors unintentionally bring spores and fungi from the outside world to the delicate cave environment, which can throw off the cave's ecosystem. Oils, dust, and lint brought in by human visitors build up on cavern walls and speleothems, affecting the survival of troglofauna and the continued growth of speleothems.

Conserving Our Caves

Caves are a unique and vulnerable part of nature and our history. It is important that we take care of them. They hold the answers to many questions about human history. They are an important source of shelter and clean water to many trogloxenes and troglophiles, and they are absolutely necessary for the lives of troglobites. We must take action *now* to save our caves.

What Can We Do?

- ***Visit more caves! By visiting caves, we are able to learn about them and spread our knowledge of these beautiful works of nature. The more people that love caves, the more caves that will be saved.***
- ***Be cautious when visiting a cave. Do not touch anything in the delicate cavern environment.***
- ***Do not litter, either above ground or below. Garbage that isn't properly disposed of can cause water pollution, which is harmful to the cave and to the cave-dwelling animals.***
- ***Never enter a cave without permission.***
- ***When you visit a cave, leave behind nothing that wasn't already there and only take away memories.***

BIG IDEAS

Lesson 5: People and Caverns

*Caves have been used by humans as far back as two million years ago.

*Caves have been used for shelter, storage, religion, ceremonies, burials, mining, protection, and more!

*Cave are delicate and can be easily destroyed.

*Humans often have a negative impact on caves, even if it is accidental.

*Water pollution is very bad for a cave and the life within.

*We can help conserve caves.

Lesson 5: People and Caverns Experiment Idea

(For the Teacher)

How Does Pollution Get in a Cave?

***Note: You could either do this as a large group activity or have activity stations set up for multiple groups.**

Materials

- Large plastic jug, preferably clear (milk jugs and ice cream tubs work great for this)
- Funnel
- Water
- A catch-basin
- "Pollution" materials (food coloring, dirt, vegetable oil, soap, paint, rubbing alcohol, small bits of trash, sand, etc.)
- Student worksheet, included

Preparation

- Punch a few holes of different sizes in the jug, near the bottom.
- Place or tape a funnel in the mouth of the jug.
- Sit the jug in the catch-basin or hold it over the basin during the experiment

Procedure

- Explain to students that the funnel represents a sinkhole leading into a cave, which is the jug. Show them how rainwater runs into a cave and then continues on into the ground by pouring clean water into the funnel.
- Add various materials, one at a time, to the funnel and watch what happens when more water is added.
- Allow students to explore the water (look, smell, touch) and the cave after adding "pollution."
- Repeat with the other materials on hand and watch how the "cave" is affected by the materials being added.
- When the activity is complete, have students answer the questions on the worksheet

Lesson 5: People and Caves Experiment Idea

Name: _____

How Does Pollution Get in a Cave?

1. Describe how the "cave" and the "sinkhole" looked before the pollution was added.

2. What happened to the inside of the "cave" as it was polluted? What happened to the water coming out of the cave?

3. Which items had the greatest effect? Which items might be found in a real sinkhole?

4. Why is water pollution in a cave a bad thing?

Name: _____

Field Trip Date: _____

School: _____

Learning UNDERGROUND
Squire Boone Caverns
Field Trip Guide

Lesson 5: People and Caves

DIRECTIONS: Answer each of the following questions either during or after your cavern tour at Squire Boone Caverns. If your tour guide doesn't say the answer during the cave tour, don't forget to ask!

1. What kind of pollutants would likely be found in Squire Boone Caverns?
A. pesticides
B. oil
C. gasoline
D. nuclear waste

2. The only cave formation you can touch in Squire Boone Caverns is...
A. Rocky
B. Freddy
C. Herbie
D. Marty

3. A cave on the park property was used as a:
A. religious site
B. military route
C. burial cave
D. storage facility

4. What evidence in Squire Boone Caverns shows it was used by Native Americans?
A. cave paintings
B. ancient tools
C. fabric
D. There is no evidence of this.

5. In what year did Squire Boone Caverns open to the public?
A. 1965
B. 1973
C. 1992
D. 2001

Lesson 5 People and Caverns

OBJECTIVE

Students will be able to explain the diverse uses of caverns in both the past and the present.
Students will be able to identify ways cavern environments can be destroyed.
Students will be able to explain the importance of cavern conservation and how caverns can be protected while still being enjoyed by people.

DIRECTIONS: Answer each of the following questions in complete sentences.

1. How were caverns used by people in the past?

_____

_____

_____

2. How can cavern environments be destroyed by people?

_____

_____

_____

3. Why is it important to protect caves?

_____

_____

_____

4. What can <u>you</u> do to help protect caverns?

_____

_____

_____