

## Chapter 2: Bat Shows Off the Cave

**NATURAL BRIDGE  
CAVERNS.**

Jenny switched on the flashlight the bat had discovered. Now they could see in the dark. She and Carlos stared at the underground world in amazement. Strange rocks decorated the cave. Some hung from the ceiling, like icicles. Others, like pointy tree stumps, grew from the floor. Flowery crystals grew from the wall where Carlos stood. Jenny stared at curtains of pinkish stone draped down the walls across from where she stood. Both children were struck speechless in this dark and lovely place.

For the first time, they could see their cave guide. The bat hung upside down by the little claws of his hind feet. He dangled from a ledge on the cave wall. They could see his brown snout and big ears. Dark, glittering eyes stared out from a black mask. A coat of chestnut brown fur made him look warm and cozy in the dark cave. Strangest of all were his paper-thin black-brown wings - folded up close to his body like brown paper napkins.

The children had never imagined anything like this cave. As their eyes got used to the faint light of the flashlight, more and more curious structures appeared. They didn't know where to begin looking.

*The cavers I met made maps of the cave. Too bad you two don't have a map,* teased Bat.

The children did not think it was a funny joke. But they wondered.

"What's a caver?" they asked.

*Oh, they are people who like to explore caves,* Bat explained. *They wear special clothes and boots. On their heads, they wear helmets with lights. They also carry flashlights. They climb up and down the cave walls with ropes. They act pretty goofy sometimes and laugh a lot. They draw little maps in notebooks.*

"I wish we had some caver equipment like that," Carlos said. Many questions were going through the children's minds.

How did this cave get here?

Why didn't anybody at science camp know about this cave?

Where were the water sounds coming from?

How would they get out of here?

Bat's squeaky voice broke into their thoughts. *You see why I wanted to find you the flashlight, he commented. Let me show you around now.*

Bat spread his little brown wings. He launched himself from the cave wall and flapped around in circles over the children's heads.

"Hey Bat," Carlos asked, "how do you see in the dark with this sonar you told us about?"

*Well, remember the echoes you heard? It's kind of like that. The squeaks you hear - I use those for talking to other bats mostly. I can tell how close something is by making a signal that you humans can't hear - only I can hear it. The signal goes out and hits things - like the wall. Then, an echo bounces back and hits my big ears. If it comes back fast, I know I'm going to hit the wall or something pretty soon - like you and Jenny did back there. So I make a turn. If the echo takes a longer time to come back, I can keep going for a while without hitting something.*

"Do you always use sonar?" Jenny asked.

*No. I use my eyes when we fly out of the cave in the evening, before it gets really dark. And in the cave, sometimes I forget to use my sonar and I bump into things just like a human. It's embarrassing.*

Jenny giggled. "It's like you have two pairs of eyes," she said. Carlos took the flashlight and looked around at the strange rock shapes. He asked Bat how they got there.

Bat flew to a nearby rock hanging from the ceiling. He hung from the ceiling and started to answer.

*Well ...*

"And why is everything wet?" Carlos interrupted, "I've heard water dripping from somewhere ever since we got in the cave. And somewhere I can hear a stream too."

*... it took water and stone to make this cave. See the rock all around us? It's called limestone. The cave used to be solid rock. It used to have cracks in it, but the cracks got wider and wider until they turned into caves and tunnels.*

"How do the cracks get so big?" asked Jenny.

*Water trickles down through the earth above us. Especially when it rains like today. And it rushes through*

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*the limestone in underground streams. When the water goes through cracks in the limestone, the limestone dissolves away slowly, because the water has a little bit of acid in it.*

*As the limestone cracks get wider, more and more water can flow through the cracks. After a while, the water can become an underground stream.*

"You mean water can make rock go away? Like water makes soap go away in the bathtub?" Carlos asked.

*Well, I don't know what soap is. I've watched the cave explorers make tea. Sometimes they put sugar in the tea and the sugar goes away. It dissolves. The rocks are like the sugar.*

*Even hard rocks like limestone dissolve. But in a cave it happens slowly. Over a long time - oh, like millions of years - the cracks get bigger and bigger. Some of the cracks turn into tunnels, like the one you just crawled through. After awhile the tunnels get bigger and bigger. Some of them join with other tunnels and we get big cave rooms.*

"Did the tunnels dissolve into big rooms like this?" Jenny asked. "Is the rock in this cave still dissolving?"

*Oh yes. The rock in this cave is dissolving all over the place. Listen to all that water dripping! The tunnels grow into big rooms. Cave explorers call big cave rooms 'caverns.'*

The sound of drips went on. The children couldn't tell which drips were drops or which were the echoes of drops. They wondered how many drops could carve out such a big thing as a cave. Carlos thought it would be even slower than the growth of tree rings they had seen at science camp.

"What about these weird shapes?" Jenny asked. "How do they get here? We don't see these above ground."

The Bat went on. *No, you don't, Jenny. It's water again. When water drips through the limestone, it picks up tiny bits of limestone. You know, dissolved in the water, just like sugar in tea. So you can't see it. When a drop hits the ground, the water dries up. The limestone in the water gets left behind - or deposited. A coating of tiny crystals slowly builds up.*

Bat looked at the icicle shapes hanging from the cave ceiling. *Or down, he added. That's how these strange stones take shape. And it's slow again. It takes thousands of years to make some of these rock shapes. It's funny,* laughed the bat. *In one part of the cave, water deposits the crystals. In another place, water dissolves crystals away.*

"I don't believe this. Water can't do all this," said Jenny doubtfully. She stepped back to look at the rocks hanging from the ceiling.

"Watch out Jenny!" Carlos shouted.

Just in time, Jenny glanced behind her. A small stream was flowing through the cave behind her. It was a fast-running stream, but she had not heard it. Her foot dipped into the stream. Splash! Jenny yanked her dripping foot out of the water as if she had stepped into a hot campfire.

"Oh no! My foot's all wet," she complained. Carlos shone the flashlight on her as she shook off the wet foot. The worried Bat flapped around in circles.

Suddenly Jenny put her foot down. She stared into the stream.

"Carlos!" she whispered. "Look there! Shine the light in the water. Something's over there. Look! There's ... oh, I don't believe it!"

A silvery white creature glided through the water. Then it darted off like a flash of light, a watery ghost. It disappeared behind a rock.

*Oh, hi fish.* Bat squeaked. *This is Jenny. Sorry she fell in your stream. She won't hurt you.*

Bubbles streamed up from the fish, still hiding behind a piece of limestone. "He nudged my foot," Jenny said. "I think he was trying to say hello." The children listened as the bat squeaked excitedly.

*I'm glad the fish is back, said Bat. Last year, limestone caved in under a garbage dump on the surface. It caused a sinkhole. The garbage and pollution in the sinkhole fell into this underground stream. Most of the cave fish got very sick from the poisons in the garbage. This fish was OK because she was laying eggs in a place that didn't get the poison. You can see why troglobites don't like people very much.*

"Troglo-whats?" Jenny and Carlos asked at once. *Troglobites, cave dwellers,* the bat explained patiently. *Don't you humans know anything? The cavers knew the word. They say that troglobites are animals that can't ever leave the cave or live anywhere else. Here we have white troglobite daddy longlegs and salamanders and centipedes. They look different from their surface cousins, but they are close relatives.*

# Reading Follow-up Activity— Chapter 2



**SUBJECTS:** English, Language Arts & Reading and Science

**GRADES:** K-3

**ACTIVITY SUMMARY:** Students will discuss how caves are formed and the types of animals found in caves.

**DURATION:** approximately 45-60 minutes

## **OBJECTIVES:**

Students will be able to:

1. Explain how water and limestone interact to form caves.
2. \*Define “troglolite,” “troglolene,” and “troglolile.”
3. Describe some of the dangers of cave exploration.
4. Explain how water makes cave rock formations.

The lesson can be used to prepare students for a cave field trip or as a follow-up after a trip.

\*For more advanced students.

## **TEKS ADDRESSED:**

### Kindergarten-English, Language Arts, and Reading

4B—ask and respond to questions about texts read aloud.

17A—form upper- and lower-case letters legibly using basic conventions of print (left-to-right and top-to-bottom progression).

17B—capitalize the first letter in a sentence.

17C—use punctuation at the end of a sentence.

### 1<sup>st</sup> grade-English, Language Arts, and Reading

4C—establish purpose for reading selected texts.

21A—form upper- and lower-case letters legibly in text, using the basic conventions of print (left-to-right and top-to-bottom progression), including spacing between words and sentences.

21B—recognize and use basic capitalization for:

- (i) the beginning of sentences.
- (ii) the pronoun “I”.
- (iii) names of people.

21C—recognize and use punctuation marks at the end of declarative, exclamatory, and interrogative sentences.

### 2<sup>nd</sup> grade-English, Language Arts, and Reading

3C—establish purpose for reading selected texts.

17A—plan a rough draft by generating ideas for writing (e.g., drawing, sharing ideas, listing key ideas).

17B—develop drafts by sequencing ideas through writing sentences.

17C—revise drafts by adding or deleting words, phrases, or sentences.

17D—edit drafts for grammar, punctuation, and spelling using a teacher developed rubric.

17E—publish and share writing with others.

22A—write legibly leaving appropriate margins for readability.

22B—use capitalization for:

- (i) proper nouns.
- (ii) months and days of the week.

(iii) the salutation and closing of a letter.

22C—recognize and use punctuation marks, including:

- (i) ending punctuation in sentences.
- (ii) apostrophes and contractions.
- (iii) apostrophes and possessives.

### 3<sup>rd</sup> grade-English, Language Arts, and Reading

2C—establish purpose for reading selected texts.

23A—write legibly in cursive script with spacing between words in a sentence

23B—use capitalization for:

- (i) geographical names and places.
- (ii) historical periods.
- (iii) official titles of people.

23C—recognize and use punctuation marks including :

- (i) apostrophes in contractions and possessives.
- (ii) commas in series and dates.

23D—use correct mechanics including paragraph indentions.

### Kindergarten-Science

9B—examine evidence that living organisms have basic needs such as food, water and shelter for animals and air, water, nutrients, sunlight, and space for plants.

### 1<sup>st</sup> grade-Science

7C—gather evidence of how rocks, soil, and water help to make useful products.

10A—investigate how the external characteristics of an animal are related to where it lives, how it moves and what it eats.

### 2<sup>nd</sup> grade-Science

9A—identify the basic needs of plants and animals.

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9B—identify factors in the environment, including temperature and precipitation, that affect growth and behavior such as migration, and dormancy of living things.

9C—compare and give examples of the ways living organisms depend on each other and on their environments such as food chains within a garden, park, beach, lake and wooded area.

10A—observe, record and compare how the physical characteristics and behav-

iors of animals help them meet their basic needs such as fins help fish move and balance in the water.

### 3<sup>rd</sup> grade-Science

10A—explore how structures and functions of plants and animals allow them to survive in a particular environment.

**VOCABULARY:** cave, fish, dissolve, limestone, sonar, troglobite, troglone, troglophile, caver, claw, ears, safe, worm, black, brown, lovely, joke, pair, shone, snout, stone, strange, stump, wings, amazement, brown, tunnel, soap, comment, mistake, napkin, flap, cavern

### **MATERIALS PROVIDED:**

Handout: Chapter 2 Coloring Page

### **MATERIALS REQUIRED:**

Brochures from commercial and park caves

Crayons

### **PROCEDURE:**

1. Read Chapter 2 of *Exploring Caves* out loud to the students.
2. Distribute the coloring page.
3. While students are coloring, talk about the discussion questions below. Ask them to point out the following items on their coloring page: cave fish, limestone, troglone, troglobites, troglophiles, crystal formations, and underground stream.
4. Incorporate vocabulary into writing and vocabulary lessons.
5. Assign writing topics.

### **DISCUSSION QUESTIONS:**

1. There are two kinds of caves: “show caves” and “wild caves.” A show cave is one that has been developed with lights, handrails, and walking trails. They can be privately owned or part of a national or state park system. A wild cave has undeveloped cavern passages and rooms. They can also be privately owned or part of a national or state park system. Natural Bridge Caverns has both show cave and wild cave passages. Show the class cave brochures from commercial and park caves.
2. How does water help make caves?
3. What is the main kind of rock in American caves? (*Limestone and related rock such as marble*)
4. Limestone was made from the skeletons of coral and seashells millions of years ago in the bottom of the ocean. What could you find in limestone? (*Fossils of ocean animals such as coral and clams*)
5. Other caves are made in lava rocks. Where does lava come from? (*Volcanoes*) What parts of the United States have lava? (*Western United States, including Hawaii and Alaska*)
6. Discuss examples of “troglobite,” “troglone,” and “troglophile.” What are the differences?

### **Writing Assignment**

- Think about what you have learned so far. Write three questions that you would like to ask a talking cave bat.
- What would a bat want to tell a reader about his habitat?  
(Some good books to use for points of view are *Diary of a Worm*, *Diary of a Spider*, and the *Dear Mrs. LaRue* series of books. This will give the students a good idea of “voice.”)





# Cave Diagram



**SUBJECTS:** English, Language Arts & Reading and Science

**GRADES:** K-3

**ACTIVITY SUMMARY:** This activity takes a closer look at limestone cave geology and hydrology, using a cutaway drawing of a cave system. Students will learn additional cave vocabulary, and consider the implications of underground structure on planning human communities.

**DURATION:** approximately 45-50 minutes (Add 15-20 minutes if need to read story first.)

## OBJECTIVES:

Students will be able to:

1. Define dry cave, wet cave, underwater cave, sink hole, shaft, and water table.
2. Describe at least two ways that pollution can enter cave systems.
3. Explain why it is important for communities in limestone areas to map their cave locations.
4. Explain that bats are not blind, and how they use sonar to navigate in the dark.

## TEKS ADDRESSED:

### Kindergarten-English, Language Arts, and Reading

4B—ask and respond to questions about texts read aloud.

17A—form upper- and lower-case letters legibly using basic conventions of print (left-to-right and top-to-bottom progression).

17B—capitalize the first letter in a sentence.

17C—use punctuation at the end of a sentence.

### 1<sup>st</sup> grade-English, Language Arts, and Reading

4C—establish purpose for reading selected texts.

21A—form upper- and lower-case letters legibly in text, using the basic conventions of print (left-to-right and top-to-bottom progression), including spacing between words and sentences.

21B—recognize and use basic capitalization for:

- (i) the beginning of sentences.
- (ii) the pronoun “I”.
- (iii) names of people.

21C—recognize and use punctuation marks at the end of declarative, exclamatory, and interrogative sentences.

### 2<sup>nd</sup> grade-English, Language Arts, and Reading

3C—establish purpose for reading selected texts.

17A—plan a rough draft by generating ideas for writing (e.g., drawing, sharing ideas, listing key ideas).

17B—develop drafts by sequencing ideas through writing sentences.

17C—revise drafts by adding or deleting words, phrases, or sentences.

17D—edit drafts for grammar, punctuation, and spelling using a teacher developed rubric.

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22A—write legibly leaving appropriate margins for readability.

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- (i) proper nouns.
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22C—recognize and use punctuation marks, including:

(i) ending punctuation in sentences.

(ii) apostrophes and contractions.

(iii) apostrophes and possessives.

### 3<sup>rd</sup> grade-English, Language Arts, and Reading

2C—establish purpose for reading selected texts.

23A—write legibly in cursive script with spacing between words in a sentence

23B—use capitalization for:

- (i) geographical names and places.
- (ii) historical periods.
- (iii) official titles of people.

23C—recognize and use punctuation marks including :

- (i) apostrophes in contractions and possessives.
- (ii) commas in series and dates.

23D—use correct mechanics including paragraph indentions.

### Kindergarten-Science

7A—observe, describe, compare and sort rocks by size, shape, color and texture.

### 1<sup>st</sup> grade-Science

10A—investigate how the external characteristics of an animal are related to where it lives, how it moves and what it eats.

### 2<sup>nd</sup> grade-Science

9A—identify the basic needs of plants and animals.

10A—observe, record and compare how the physical characteristics and behaviors of animals help them meet their basic needs such as fins help fish move and balance in the water.

### 3<sup>rd</sup> grade-Science

9A—observe and describe the physical characteristics of environments and how they support populations within an ecosystem.

10A—explore how structures and functions of plants and animals allow them to survive in a particular environment.

**VOCABULARY:** diagram, dry cave, wet cave, underwater cave, shaft, sink hole, sink-stream, pollution, water table, wet, hole, dry, stream, danger, tunnel, diver, sink, pollute

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## **MATERIALS PROVIDED:**

Handout: Cave Diagram

## **MATERIALS REQUIRED:**

Crayons

## **PROCEDURE:**

1. Read Chapter 2 of the story to the students (if you have not already done so).
2. Ask the question: Why is cave mapping important? Discuss answers. (*Maps prevent cavers from getting lost. They also keep road and building constructors from building on sinkhole areas, and maps help prevent pollution of underground water.*)
3. Distribute copies of Cave Diagram handout.  
Locate and discuss new features that have not been discussed before:
  - Dry cave: a cave with no standing water or streams.
  - Tunnel: a long, narrow, horizontal passage.
  - Shaft: a long, narrow, vertical passage, going up and down or sloped, which may require special climbing equipment. Vertical shafts are often located at the bottom of sinkholes.
  - Sink Hole: place where a cave used to be near the surface. When the limestone roof of the cave collapses, a sinkhole is created. On the surface, a sinkhole might just look like a steep hole. (Note: one sinkhole is labeled. Ask students to locate the others.)
  - Sinking Stream: a stream suddenly disappears underground into a cave system.
  - Water Table: the level below which all openings in rock are filled with water.
  - Wet cave: a cave with underground standing water, seepage, stream, or ponds.
  - Underwater cave: a cave that develops below water level. Cave divers explore these caves.
4. Ask students to use a blue crayon to trace all the ways water can get into the caves. Remind them that water will seep through soil. Ask them to color all bodies of water above and below ground. Use a red crayon to show how pollution could move from the factory, through cave passages, to the ocean.
5. Ask students to identify underground features that could be dangerous to people.
  - Sinkholes: If people do not have good cave maps they won't know where sinkholes are developing. Because of this, many houses, roads, animals, and farmlands, have fallen into sinkholes.
  - Shafts: Good cave maps will show where shafts are. Caverns can use climbing equipment to get in or out of shafts. Maps will also keep people from falling into shafts in caves.
6. Ask students to identify dangers to caves.
  - Sinking Streams: If streams are polluted, they can carry pollution to cave fish and other animals. Pollution can come from houses, from factories, and from roads.
  - Sinkholes: Many people use sink holes for dumping garbage. Pollution from garbage can harm cave animals.
7. Ask the students what they would change about the drawing if they were in charge of where to build factories, houses, and roads. Discuss.

## **DISCUSSION QUESTIONS:**

1. If bats are not blind, how do they find their way in the dark?
2. Why are no two caves the same shape?

## **WRITING ASSIGNMENT:**

1. Think about the different openings where water goes underground. What happens next? Write a paragraph describing how rainwater gets into a wet cave.
2. Think about how bats "see" in the dark. Explain how bat sonar works.

