NPS Photo by Rick Wood

Caves and Karst: Interactive Reading Guide #1

Lesson Objective: This interactive reading guide was developed to compliment the "Views of the National Parks" Knowledge Center for Caves and Karst, and the design of this guide will help students focus their attention on key concepts as they are introduced to cave and karst resources.

Key Concepts: cave basics, karst basics, cave and karst locations, types of caves, processes that form caves and karst, cave and karst formation, and the environment conditions inside a cave.

Duration: 1 55-minute class period

Audience: Middle school and high school students

NPS Photo by Rick Wood

Interactive Reading Guide #1

Teacher Copy and Answer Key

CAVES AND KARST

(To compliment the NPS Views Caves and Karst Knowledge Center)

Interactive Reading Guide #1

Interactive reading guides are excellent strategies to use when assisting students in productive reading. They allow students to find the essential ideas within a text without being distracted by large amounts of information. Students who may find it difficult to differentiate key ideas from the supporting detail benefit from the clues and guidance of reading guides. Essentially, interactive reading guides are developed to assist students with text materials that may be too difficult for independent reading.[1]

This particular interactive reading guide has been developed to supplement the "Views of the National Parks" (Views) Knowledge Center for Caves and Karst, and the design of this guide will help students focus their attention as they interact with the Caves and Karst module. The introduction segment of this module is an excellent way to introduce students to cave and karst topics, and this guide has been developed in order to maximize their learning of key topics.

The instructor can download the Views DVD to the school's public server, or if the instructor does not have a DVD they can have the students access the Knowledge Center via the internet.

Enter the knowledge center by clicking on the "Explore Caves and Karst" link.

Click on the link to Cave Basics

1. **How does the Federal Cave Resource Protection Act of 1988 define a cave?**

   "ANY NATURALLY OCCURRING VOID, CAVITY, RECESS, OR SYSTEM OF INTERCONNECTED PASSAGEWAYS BENEATH THE SURFACE OF THE EARTH."

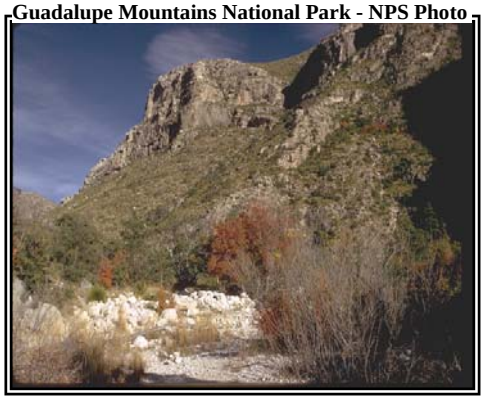
2. **True or False: Caves can be filled with air, but not water. Circle one: True (False)**
3. **What are 4 things that can be housed within a cave?**

   - *FRAGILE MINERAL FORMATIONS*
   - *RARE FLORA AND FAUNA*
   - *IRREPLACEABLE ARTIFACTS*
   - *DISTINCTIVE FOSSILS*

[1] Source: Classroom Strategies for Interactive Learning, 2nd Edition. Written by Doug Buehl; Copyright 2001 by the International Reading Association, Inc.

What is karst?

Guadalupe Mountains National Park - NPS Photo



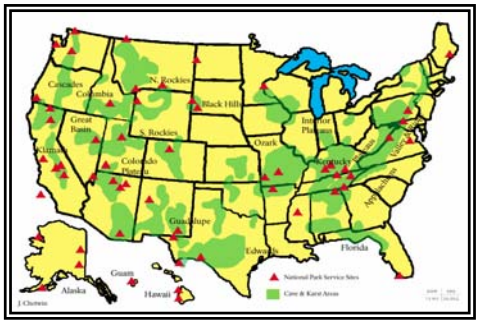
Karst is a type of topography. If we think of topography as the different features in a landscape, then karst landscapes are characterized as being formed on limestone, gypsum, and other types of rocks that dissolve in natural acid.

Click on the link to Karst Basics

1. **What type of topography does karst describe? What happens to streams in karstic areas?**
   KARST DESCRIBES LANDSCAPES CHARACTERIZED BY CAVES, SINKHOLES, AND UNDERGROUND DRAINAGE.

   IN KARSTIC LANDSCAPES, STREAMS DISAPPEAR INTO THE GROUND AND REAPPEAR ELSEWHERE AS LARGE SPRINGS.
2. **Name 5 surface features that are found in regions with karst:**
   - *VALLEYS*
   - *PLATEAUS*
   - *TOWERS*
   - *PINNACLES*
   - *PONDS*
3. **Name 3 components of a drainage network:**
   - *CAVES*
   - *FRACTURES*
   - *PARTINGS*

NPS Map - Cave and Karst Locations in the USA



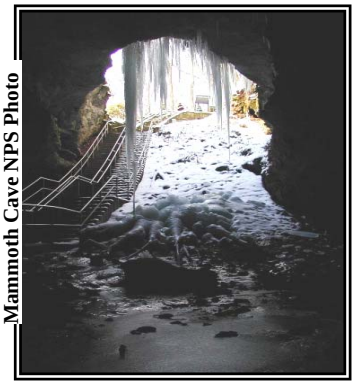
Where are Caves and Karst?

Now that you know the cave and karst basics, let's learn about where they are found. Karst landscapes are found just about everywhere on Earth: frigid tundra, dry deserts, and tropical jungles. In temperate & tropical climates flowing water dissolves rocks. In arid environments, sulfuric acid can dissolve rocks and form caves.

Click on the link to Cave and Karst Locations

1. **What portion of the landscapes in the United States is karstic?** *1/5 (A FIFTH OF THE LANDSCAPE)*

TEACHER COPY AND ANSWER KEY



Mammoth Cave NPS Photo

Types of Caves

There are many different types of caves that can form in many different types of locations: there are long caves, deep caves, caves that form in the desert, and caves that form near the sea.

Click on the link to Types of Caves

1. **What is the longest cave?** *MAMMOTH CAVE*
2. **Where is the longest cave located?** *KENTUCKY*
3. **The deepest cave in the world is the** _____*KRUBERA (VORONJA)*_____ **cave.**
4. **How many types of caves are there?** _____*23*_____
   (Hint: you have to click on the "next->" link)

What Processes Form Caves and Karst?

Click on the link to Cave and Karst Formation

(Use the link to the glossary to fill in the following blanks)

Caves are typically formed in rocks through processes like *dissolution* and *carbonation*. *Dissolution* is the act or process of ___ *DISSOLVING* ___. If an area is warm and humid there is more water available to dissolve rock, increasing the rate of erosion and cave formation. Carbonate rocks are those that primarily consist of _____ *CARBONATE* _____ minerals. Specifically, carbonate rocks are ____ *SEDIMENTARY* _____ rocks, and go through a process called "*carbonation*". *Carbonation* is an activity of chemical _____ *WEATHERING* _____. It is a ____*CHEMICAL*_____ reaction of carbonic acid in rainwater, soilwater, and groundwater, with _____*MINERALS*_____. *Carbonation* most strongly affects carbonate minerals and rocks, such as _____ *LIMESTONE* ____ and _____ *MARBLE* _____.

Different Ways that Caves and Karst Form

Caves and karst can form in many different ways. They can form in areas where abundant rainfall increases the rate of dissolution and carbonation. Although this type of formation is common, it is not the only way to form caves and karst. Other processes are at work forming caves and changing karstic landscapes. The following examples are common ways that caves and karst are forming all around us.

Click on the link to Cave and Karst Formation

(Use the "next ->" link to see different ways that caves and karst form)

1. Collapse

- **Collapse is part of cave _____ *FORMATION* _____ and _____ *EVOLUTION* _____.**
- **When do the ceilings of cave rooms and passages collapse?**

WHEN THEY BECOME TOO WIDE TO SUPPORT THE BEDROCK OVERLYING THEM

- **The ceilings of water-filled caves may be supported by the buoyant force of the water inside. If this water drains out, why is there a greater potential for the cave to collapse?**

BECAUSE THE BUOYANT FORCE IS NO LONGER PRESENT TO HELP SUPPORT A CAVE'S CEILING.

2. Solution Caves

- ***Finish the following paragraph*:**

Earth movements cause cracks to form in the *bedrock*, which is the solid rock below the surface. These cracks, which are natural pipelines for water to seep into the ground, are called _____ *FRACTURES* _____ and _____*JOINTS*_____. When the water mixes with the natural acids in the ground, rocks such as limestone are dissolved.

- **What remains after the dissolved particles are carried away with the water?**

HOLLOW SPACES

- **<u>WHERE</u> does most cave formation and enlargement take place, and <u>WHY</u> is the circulation and dissolution of bedrock greatest at this place?**

FORMATION AND ENLARGEMENT TAKES PLACE AT OR JUST BELOW THE WATER TABLE;
THE CIRCULATION IS GREATEST HERE BECAUSE FRACTURES ARE CONNECTED AND MOST OPEN.

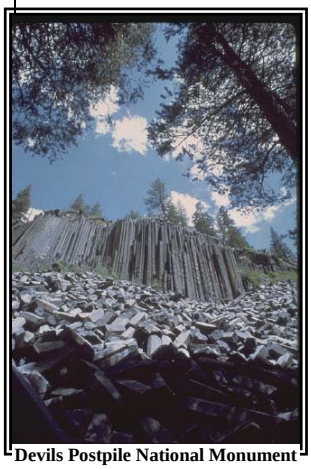
3. Lava Caves

- **What is another name for a lava cave?** ***LAVA TUBE***

- ***Finish the following paragraph*:**

When molten, fluid _____ *LAVA* _____ flows out of a volcano, it works its way downhill. In contact with _____ *AIR* _____, the surface of this lava stream cools and hardens into a _____ *CRUST* _____. The lava inside remains _____ *MOLTEN* _____, however, and continues to _____ *FLOW* _____ downhill. When the molten lava eventually _____ *DRAINS* _____ out of the interior of the hard-crusted passage, a lava _____ *TUBE* _____ or _____ *CAVE* _____ remains.

4. Talus Caves



Devils Postpile National Monument
NPS Photo

- **Rockslides and rockfalls produce piles of irregular shaped rocks and boulders. The spaces between these rocks are sometimes big enough to produce a cave-like configuration.**
  What is the name for these piles of rocks?
  TALUS
- **Because these types of caves can be formed when rocks break off and fall or slide into narrow canyons, talus caves are also referred to as:**
  BREAKDOWN CAVES

5. Sea Caves

- **What are sea caves?**

SEA CAVES ARE CLEFTS OR CAVITIES IN THE BASES OF CLIFFS AT THE EDGES OF LARGE BODIES OF WATER, TYPICALLY THE SEA BUT ALSO LARGE LAKES.

- ***Finish the following sentence about the formation of sea caves:***

The action of _____ *WAVES* _____ pounding against rocks that line the shores of _____ *OCEANS* _____ and large _____ *LAKES* _____ form sea caves.

6. Ice Caves

- **Ice caves that form in ice are also called:**

  GLACIER CAVES

- **Ice caves that are formed in rock that contain ice all year round are also referred to as:**

  FROZEN CAVES

7. Sandstone Caves

Mesa Verde National Park
NPS Photo

- **Early people used sandstone caves for** *SHELTER*

  Why?

SANDSTONE CAVES ARE USUALLY SHALLOW AND ARE EASILY ACCESSIBLE.

- **Define *contact*:** *GEOLOGICALLY SPEAKING, CONTACT IS THE SURFACE BETWEEN 2 TYPES OR AGES OF ROCKS.*
- **Fluids, like groundwater, move through sandstone, easily. However, when the water reaches a layer of shale, it cannot pass through because the pore spaces are too small.**

When this happens, what is groundwater forced to do?

THE GROUNDWATER IS FORCED TO MOVE LATERALLY ALONG THE CONTACT BETWEEN THE TWO ROCK UNITS UNTIL IT SEEPS OUT ON THE FACE OF THE CANYON WALL OR AT THE BACK OF AN ALCOVE, CREATING A SPRING OR SEEP.

8. Tectonic Caves

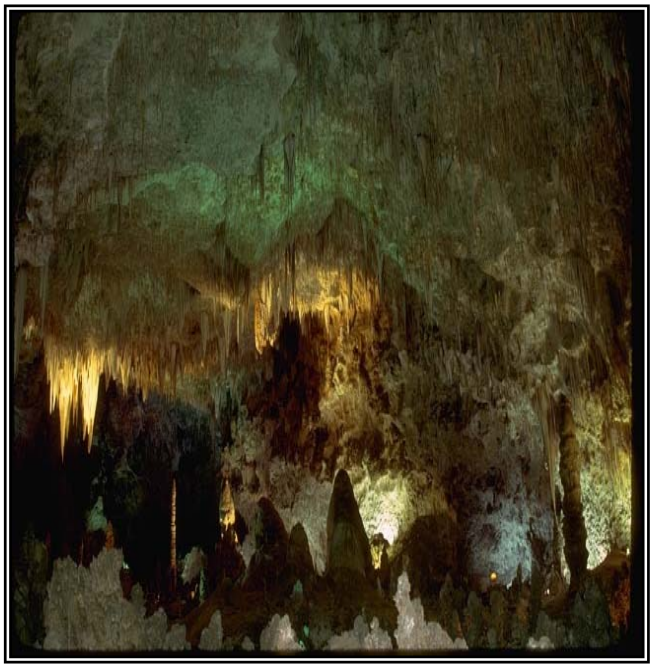
Finish the following sentence about the formation of tectonic caves:

The action of ____ *EARTHQUAKES* ____ form natural ____ *CRACKS* _____ in rock that can be considered _____ *CAVES* _____.

Wupatki National Monument - NPS Photo

Inside a Cave

Click on the "Inside a Cave" link



Carlsbad Caverns National Park – NPS Photo

What do you see when you step into a cave? What do you hear? If you are near the entrance of the cave you may see bats flying in and out. You may also hear the trickling of water as it drips down the cave walls. Although, there are times that you don't see anything at all. In fact, sometimes you don't hear anything either. Stepping inside a cave is almost like stepping into another world. The following exercises are meant to help you understand what's going on inside a cave when the lights go out.

DARKNESS

If you turn the lights out in a room, chances are your eyes will eventually adjust and you will start to see vague images of what's around you. In a cave, this may or may not be true depending on where you are. If you are near the entrance, light from outside the cave helps you to see what's around you. However, if you are in the DARKZONE, light from the outside doesn't reach you and you are in complete darkness.

- **Is the following statement true or false? Circle one: TRUE or FALSE**

*If you are in the **darkzone** of a cave, your eyes will eventually adjust to the blackness and you will be able to see your hand if your hold it up close to your face.*

- **What are 3 reasons these worlds without sunlight are important?**

1. *CAVES CHALLENGE OUR ASSUMPTIONS ABOUT ECOSYSTEMS AND LIFE.*
2. *CAVES PROVIDE A SENSE OF DISCOVERY.*
3. *CAVES OPEN UP NEW AVENUES IN RESEARCH AND SCIENCE.*

SILENCE

In general, what kinds of worlds are caves? *SILENT*

What is an example of a sound you may hear in a cave? *DRIPPING WATER*

TEMPERATURE

The daily and seasonal fluctuations that we experience on the surface of the Earth are not seen inside a cave. This is because any change in temperature on the surface fades as heat passes through the bedrock and into the caves.

- **As a result, cave temperatures are approximately equal to:**

...THE AVERAGE ANNUAL TEMPERATURE AT THE SURFACE.

Based on this information above, answer the following questions:

- **During SUMMER, are caves warmer or cooler than the outside temperature?** *COOLER*
- **During WINTER, are caves warmer or cooler than the outside temperature?** *WARMER*

RELATIVE HUMIDITY

Timpanogos Cave National Monument – NPS Photo

Name 3 things that seeping water moistens in a cave:

1. *CEILINGS*
2. *WALLS*
3. *FLOORS*

- **What is responsible for allowing the inner part of a cave to maintain its high humidity?**

  CONSTANT TEMPERATURE

- **Why is the humidity at the cave entrances relatively lower than the humidity found in the interior portions of the cave?**

  THE HUMIDITY IS LOWER AT THE ENTRANCE BECAUSE CAVE ENTRANCES ARE AT THE INTERFACE BETWEEN THE SURFACE AND UNDERGROUND.

AIR CURRENTS

The air in most caves is constantly in motion, and at times these air currents can blow up and out of the cave. This is how caves some caves were discovered, like *Wind Cave* in South Dakota and *Lechuguilla Cave* in Carlsbad Caverns National Park, New Mexico.

Carlsbad Caverns National Park - NPS Photo

- **What is the exchange of air between a cave and the surface a function of?**

  CHANGING PRESSURE OF THE OUTSIDE ATMOSPHERE

- **The air inside a cave is constantly in motion because it is constantly adjusting itself to what?**

  SURFACE CHANGES

- **If a cave has extremely strong air currents, what does it probably have 2 of?**

  ENTRANCES

- **What is the difference between a blowing cave and a breathing cave?**

A BLOWING CAVE IS CAVE THAT HAS AN ANNUAL CYCLE IN WHICH AIR BLOWS OUT OF THE LOWER ENTRANCE ALL SUMMER AND OUT OF THE UPPER ENTRANCE ALL WINTER.

A BREATHING CAVE HAS A SHORTER CYCLE THAN A BLOWING CAVE; THE AIR MOVES INWARD FOR A FEW MINUNTES AND THEN OUTWARD FOR A FEW MINUTES.