

# Discovery Tour—Field Trip



**SUBJECTS:** Science

**GRADES:** 1-8 and Earth & Space Science

**ACTIVITY SUMMARY:** Students will go on a guided tour through the Discovery Passages at Natural Bridge Caverns and learn how different geological processes formed the cavern system.

**DURATION:** 75 minutes

## OBJECTIVES:

The students will be able to:

1. Identify the different types of cave formations.
2. Explain why it is important for people not to touch the formations.
3. Describe the process by which formations grow.
4. Describe the process by which Natural Bridge Caverns formed.
5. Identify how Natural Bridge Caverns fits into the water cycle.
6. Describe the different constructive and destructive forces that work to form Natural Bridge Caverns.

## TEKS ADDRESSED:

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

7B-identify and describe a variety of natural sources of water, including streams, lakes, and oceans.

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

7B-identify and compare the properties of natural sources of fresh water and salt water.

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

7C-identify and compare different landforms including mountains, hills, valleys, and plains.

### 4<sup>th</sup> grade

7B-observe and identify slow changes to Earth's surface caused by weathering, erosion, and deposition from water, wind and ice.

### 5<sup>th</sup> grade

7A-explore the processes that lead to the formation of sedimentary rocks and fossil fuels.

7B-recognize how landforms such as deltas, canyons, and sand dunes are the result of changes to Earth's surface by wind, water, and ice.

### 6<sup>th</sup> grade

10B-classify rocks as metamorphic, igneous, or sedimentary by the processes of their formation.

### 7<sup>th</sup> grade

8B-analyze effects of weathering, erosion, and deposition on the environment in ecoregions of Texas.

### 8<sup>th</sup> grade

9B-relate plate tectonics to the formation of crustal features.

### Earth & Space Science—High School

11A-compare the roles of erosion and deposition through the actions of water, wind, ice, gravity, and igneous activity by lava in constantly reshaping Earth's surface.

## NATIONAL SCIENCE STANDARDS:

Content Standard D: Earth and Space Science

### Grades K-4

Properties of Earth Materials

- Earth materials are solid rocks and soils, water, and the gases of the atmosphere. The varied materials have different physical and chemical properties, which make them useful in different ways, for example, as building materials, as sources of fuel, or for growing the plants we use as food. Earth materials provide many of the resources that humans use.

Changes in Earth and Sky

- The surface of the earth changes. Some changes are due to slow processes, such as erosion and weathering, and some changes are due to rapid processes, such as landslides, volcanic eruptions, and earthquakes.

### Grades 5-8

Structure of the Earth System

- Land forms are the result of a combination of constructive and destructive forces. Constructive forces include crustal deformation, volcanic eruption,

and deposition of sediment, while destructive forces include weathering and erosion.

- Some changes in the solid earth can be described as the "rock cycle." Old rocks at the earth's surface weather, forming sediments that are buried, then compacted, heated, and often recrystallized into new rock. Eventually, those new rocks may be brought to the surface by the forces that drive plate motions, and the rock cycle continues.
- Water, which covers the majority of the earth's surface, circulates through the crust, oceans, and atmosphere in what is known as the "water cycle." Water evaporates from the earth's surface, rises and cools as it moves to higher elevations, condenses as rain or snow, and falls to the surface where it collects in lakes, oceans, soil, and in rocks underground.
- Water is a solvent. As it passes through the water cycle it dissolves minerals and gases and carries them to the oceans.
- Living organisms have played many roles in the earth system, including affecting the composition of the atmosphere, producing some types of rocks, and contributing to the weathering of rocks.

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**MATERIALS REQUIRED:** Comfortable walking shoes that provide good traction on steep, wet surfaces

**BACKGROUND:**

Natural Bridge Caverns is the most extensive cavern in the San Antonio area and one of the largest caverns in the state of Texas. The caverns possess some of the deepest passages, largest rooms, and biggest formations. While both the sinkhole entrance and small sections of the cavern have been known about for nearly a century, the full extent of the Discovery Passages was not known about until March 27, 1960. Four cavers from St. Mary's University dug out a small crawl space leading to the first room, Pluto's Anteroom, and an additional 2 miles of cavern passage. Later, drilling around the sinkhole, the land owners located another ½ mile of passage extending to the south. Now named the Hidden Passages, the two systems appear to have been connected at one time prior to the collapse of portions of the cavern. The collapse created both the sinkhole entrance to the Discovery Passages as well as the Natural Bridge from which the cavern gets its name.

Visitors to the caverns walk through different layers of limestone, a sedimentary rock. Geologists theorize that during the Cretaceous period, a warm, shallow sea covered much of Texas. Sediments and dead marine organisms collected on the ocean floor, compacted and formed the different limestone layers. Geologists give different names to the various layers, and visitors to Natural Bridge Caverns will find the Glen Rose and Edwards layers. The Glen Rose, as the oldest rock layer, contains the lowermost chambers, while the Edwards forms the Natural Bridge.

Perhaps around 20 million years ago, a number of faults formed in Texas due to the rapid falling and settling of the coastal regions. These movements created an extensive fault zone known as the Balcones Fault Zone. The eroded face of the Balcones Escarpment marks both the Fault Zone and the beginning of the Texas Hill Country. In addition to creating the faults, the tectonic stresses also created joints, or cracks in the rock. Underground water moving along the joints eventually created the passages at Natural Bridge Caverns.

Perhaps due to changes in climate, vegetation, or other natural forces, the water drained to lower levels within the earth. As the water left the upper passages, it moved deeper and started forming a second level. The water eventually moved to another level even deeper within the earth. As the water left the lower level, stresses within the rock led to many of the layers collapsing to form break-out domes. This final stage of collapse led to the creation of the passages our visitors now see.

The majority of speleothems or cavern formations can form only after water has left the passages relatively dry. All of the water seen or felt in the cavern was at one time rain. The rainwater picked up concentrations of carbon dioxide gas as it moved through the soil layers above the cavern. When the carbon dioxide mixes with water a weak solution of carbonic acid forms. This acid solution then moves through the limestone and dissolves some of the calcium carbonate. The limestone is then transported in solution to the cavern below.

When the water finally reaches the cavern, the water contains a high amount of carbon dioxide compared to the cavern's air. In an effort to reach a balance, or equilibrium, the water releases its carbon dioxide to the air inside the cavern. As a result, the water can no longer hold the dissolved calcium carbonate or calcite. The calcite in turn is deposited to form the beautiful speleothems or cavern formations such as stalagmites, stalactites, and columns seen on the tour. It is believed that the formations are currently growing at an average of one cubic inch deposited every 100 years. This growth rate is, of course, only an estimate. It is very difficult to place an age on any formation without conducting more detailed studies using isotopes.

Wherever water drips or flows in the caverns, formations may form. Those formations formed from dripping water are dripstones, while those formations formed from flowing water are flowstones. Concerning dripstones, the formations clinging to the cavern's ceiling are stalactites, and the formations rising up from the floor are stalagmites. One type of stalactite would be soda straws—hollow formations that have water flowing down the center of them. Occasionally a stalagmite and stalactite will touch, forming a column.

With regards to flowstone, the formation often is found in sheets covering large areas of the floor. Often the flowstone takes on the appearance of coral found in the ocean. Sometimes the flow of water across the floor will start to deposit thin walls. Over time these walls may grow upward to form actual dams that impede the flow of water. As the dams retain more water, the dams themselves grow larger and a network or "stair-step" system of pools and dams form. These dams are called rimstone pools. Water may also flow along the walls in narrow streams. The calcite is then deposited in narrow bands that extend outward from the wall. These are called cave ribbons, curtains, or draperies.

The Natural Bridge Caverns system lies within the Glen Rose Aquifer (Trinity Aquifer); which corresponds with the recharge zone for the Edwards Aquifer, the main water supply in this part of Texas. Recharge to the aquifer occurs primarily through seepage of rain along fractures and cracks within the rock. This water enters the cavern slowly, usually at the rate of a few inches per day. The highest recorded water level in Natural Bridge Caverns occurred in 2007 when over a three-month period of time, the water rose over 100 feet in the cavern.

**PROCEDURE:**

Students will go on a 75-minute, guided, all walking tour of the Discovery Passages at Natural Bridge Caverns.

**EVALUATION:**

Students can be evaluated by completing the Discovery tour quiz or through a teacher led discussion. The following web site provides a virtual tour of Natural Bridge Caverns and would likely help facilitate a class discussion or serve as a good review: <http://www.esi.utexas.edu/outreach/caves/virtualtours.php>

The site could also be used to help prepare students for their field trip. Some of the information on the slides is a little advanced for most elementary and middle school classes, but the pictures are good. Or, for pictures/info about the main rooms on the Discovery tour, go to [naturalbridgecaverns.com/tours.asp](http://naturalbridgecaverns.com/tours.asp). Click on the link for each room name.

**EXTENSION:**

Students can use Internet resources to virtually visit another commercial cave and then discuss the similarities and differences of that cave with Natural Bridge Caverns.

**OTHER OPTIONS:**

Students can do a scavenger hunt on tour.

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Name: \_\_\_\_\_

**Natural Bridge Caverns**  
***Discovery Tour Quiz***

1. What is the scientific term for the depression at the entrance to the cavern?
  2. Why should humans not touch the formations inside the caverns?
  3. Which type of formation grows from the floor to the ceiling?
  4. Which type of formation grows from the ceiling to the floor?
  5. What is it called if a formation stretches from the floor to ceiling?
  6. What does the water inside the cave start out as?
  7. What mineral are the formations made of?
  8. What is the growth rate of formations?
  9. What type of rock is Natural Bridge Caverns made from?
  10. What was the deepest point in the Discovery Passages?
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Name: \_\_\_\_\_

**Natural Bridge Caverns**  
***Discovery Tour Scavenger Hunt***

On your tour of Natural Bridge Caverns, your guide will talk about many different kinds of formations, and many of the formations were given names by the cavern discoverers. What room were you in when your guide showed you:

A vertical joint \_\_\_\_\_

A break out dome \_\_\_\_\_

A pillar or column \_\_\_\_\_

Flowstone \_\_\_\_\_

Cave Bacon \_\_\_\_\_

The Watchtower \_\_\_\_\_

The Mount of the Landlord \_\_\_\_\_

Grendel's Canyon \_\_\_\_\_

Fried Eggs \_\_\_\_\_

Discovery Crawlway \_\_\_\_\_

Soda Straws \_\_\_\_\_

Bat Roosts \_\_\_\_\_

A room as big as a football field \_\_\_\_\_

BONUS: What area did you walk OVER when you crossed the bridge?

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