

TIMPANOGOS CAVE
NATIONAL MONUMENT

Classroom Packet



Aligned to 4th and 5th Grade
Utah State Educational
Standards

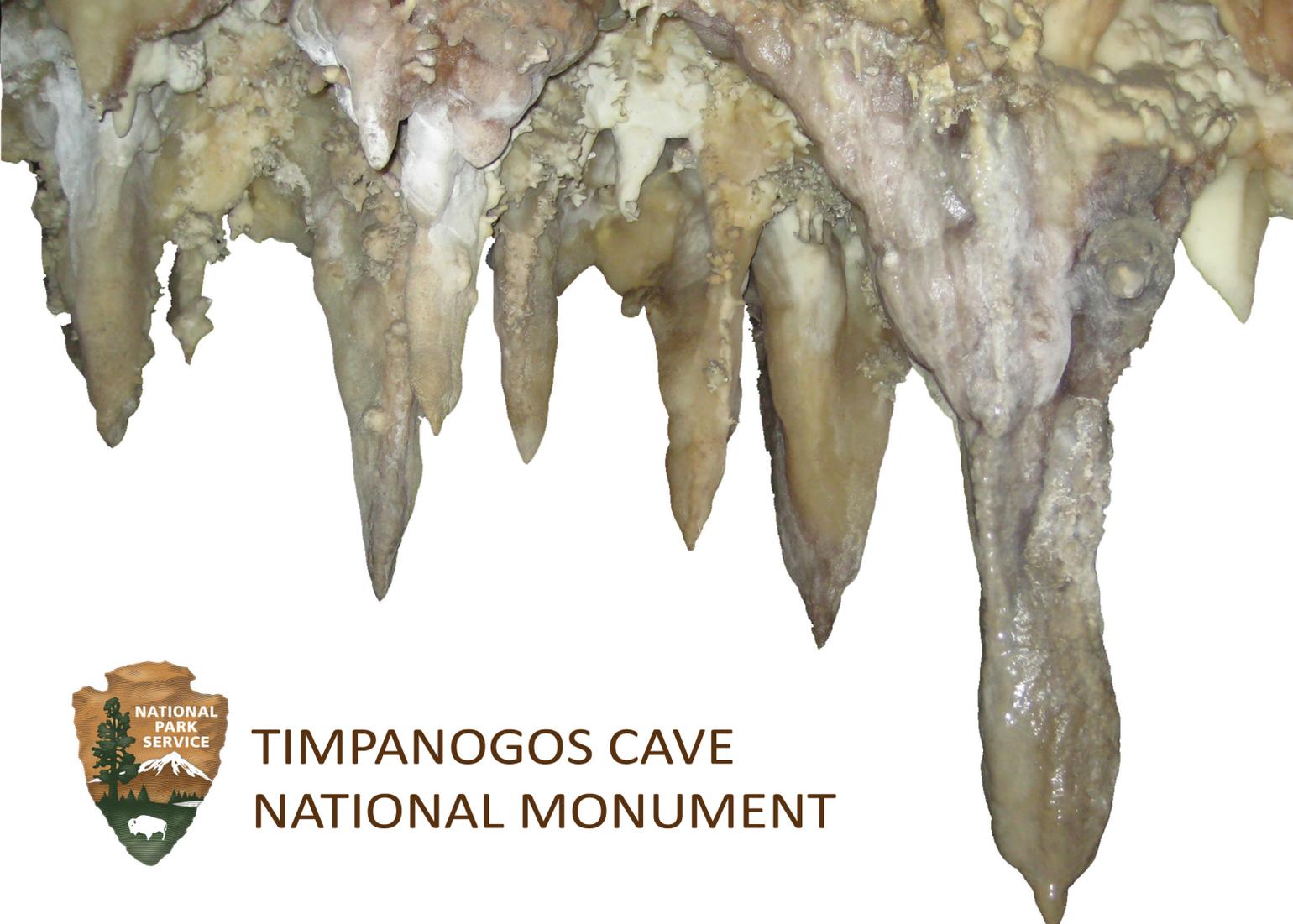


TIMPANOGOS CAVE NATIONAL MONUMENT

Classroom Packet Table of Contents

Compiled by Wendy B. Smith, 2009

- I. Introduction & Field Trip Basics
 1. What is the purpose of this packet?
 2. When you receive this...
 3. During the week before your visit...
 4. The day before your visit...
 5. The day of your visit...
 6. At the Visitor Center...
 7. On the Trail...
 8. In the Cave...
- II. Background Information – Teaching the Teachers: classroom core connections to Utah State Standards
 1. Geology
 2. Hydrology
 3. Meteorology
 4. Biology
 5. History
 6. Caves Glossary
 7. Map of Cave
- III. Lessons & Activities
 1. Pre-visit assessment/activities – Appendix A
 - a. KWL Chart
 - b. “What Do You Know About Caves”: information sheet, graphic organizer, reading comprehension sheet
 - c. Cave Recipe organizer
 - d. Reader’s Theater – “Rocky & Molly”
 - e. Making Stalactites & Stalagmites
 - f. Power Points: “Cave Basics” & “Timpanogos Cave – Before You Come”
 - g. Fieldtrip preparation sheet & answer key
 - h. Internet Resources sheet
 2. Post-visit assessments/activities - Appendix B
 - a. Follow-up with KWL Chart (Finish filling in the previous KWL Chart)
 - b. Power Points: “Cave Jeopardy”, “Cave Investigation”, “Who Wants to Be a Speleologist?” answer sheets
 - c. “What Have You Learned About Caves” quiz
 - d. Cave Newspaper Writing Activity
- IV. Field Trip and Packet Evaluation



TIMPANOGOS CAVE
NATIONAL MONUMENT

Introduction and Field Trip Basics



Aligned to 4th and 5th Grade
Utah State Educational
Standards

Introduction & Field Trip Basics

Compiled by Diantha & Wendy B. Smith and Anna Davis, 2009



What is the purpose of this packet?

The purpose of this material is two-fold:

1. To assist teachers in preparing students for a fun and meaningful visit to Timpanogos Cave National Monument.
2. To provide teachers with information, lessons, and activities directly related to the science standards in the CORE curriculum.

When You Receive This:

1. Briefly review the material and make sure you understand everything you need to know for your school's visit.
2. Confirm your travel arrangements and make sure you have adequate time set aside for the trip. You should estimate travel time to and from the Monument plus three hours for the first group of 20. Add 15 minutes for each additional group of 20.
 - a. For Example: A group of 60 individuals from a Provo school would require:
 - i. 40 minutes (Travel to the Monument)
 - ii. 3 ½ hours (for the first 20 individuals to hike and see the cave)
 - iii. 30 minutes (for the additional 40 individuals- 2 groups of 20 x 15 minutes)
 - iv. 40 minutes (Travel back to school)
 - v. TOTAL TIME: 5 hours and 20 minutes
3. Arrange for one adult chaperone for each nine students to accompany the group during the entire visit. We suggest that teachers not be a part of the adult chaperones so that teachers will be available to handle any problems that may arise. This needs to be a firm commitment. The chaperone to student ratio is very important.

During the Week Before Your Visit

To make the field trip a truly educational experience, consider discussing some of the following items and do a few of the pre-trip activities listed in Appendix A.

The Day Before Your Visit

Please review the following information with your students. A pre-visit PowerPoint is included in these materials for you to share if you wish.

1. Safety
 - a. Falling Rock: It may be helpful to explain to your students that American Fork Canyon is very young in geologic terms. The natural processes (water erosion, freezing/thawing, organic action) which formed the canyon are still actively at work making the canyon deeper and wider. To protect yourself you should do the following:

- i. Listen for the sound of falling rock. In most cases, rock fall will be heard before it is seen. Remember most injuries are caused by tennis ball size or smaller rocks, so pay attention to relatively small sounds.
 - ii. If the sound of falling rock is heard nearby, immediately duck down as near to the inside of the trail as possible and cover your head with your hands and arms. Once everyone is in this relatively safe position, you may determine the exact location of the rock fall and proceed when conditions are safe. Practice this ducking technique as a class and review it again before hiking.
 - iii. The areas on the trail that usually get the most rock fall are marked with a red stripe. Do not stop to rest in these areas and be particularly alert when crossing these sections. While rock fall can occur anywhere on the trail the benches have been placed in spots that are generally free of debris.
2. Water – Each individual should bring sufficient water for the hike to and from the cave. There is no place to refill water bottles on the trail or at the cave.
3. Clothing
 - a. Please remind your students that they will be hiking 3 ½ miles and that the cave temperature is in the low 40's, the same as in a refrigerator. They should each wear comfortable walking shoes (not sandals or flip flops) and bring a jacket or sweater for the inside of the cave.
 - b. It is wise to check the weather forecast. If rain is likely, have students bring their raingear. Teachers sometimes bring a box of large garbage bags to use as make-shift ponchos. Rain increases the likelihood of rockfall.
4. Name Tags
 - a. Name tags are helpful to both the guides and adult chaperones in talking to the groups.
 - b. The students can be divided into the groups of 20 (18 students and 2 chaperones) in which they will tour the caves. (If more than one classroom is involved, the teachers will have to coordinate dividing into groups.) The name tag of each group should be color coded. This avoids a great deal of confusion at the visitor center and makes it easy for adult chaperones to identify their group.

The Day of Your Visit

1. Before leaving the school
 - a. If you are delayed or are not sure of conditions at the Monument, call us at (801) 756-5238. Arriving as few as ten minutes late changes everything due to regular visitors purchasing cave tour tickets. Please call.
 - b. Be sure all adult chaperones are present (at least one per every nine students). Give each adult a copy of the "Group Leader Responsibility" page and ask them to read it before you arrive at the park. You may also send this page home prior to the field trip for the chaperones. The more familiar they are with their responsibilities, the better.
 - c. Have all students use the restrooms at school prior to your departure.
2. When you arrive at the Visitor Center
 - a. Please have the person in charge of the trip contact the rangers in the Visitor Center **before you unload the buses.**

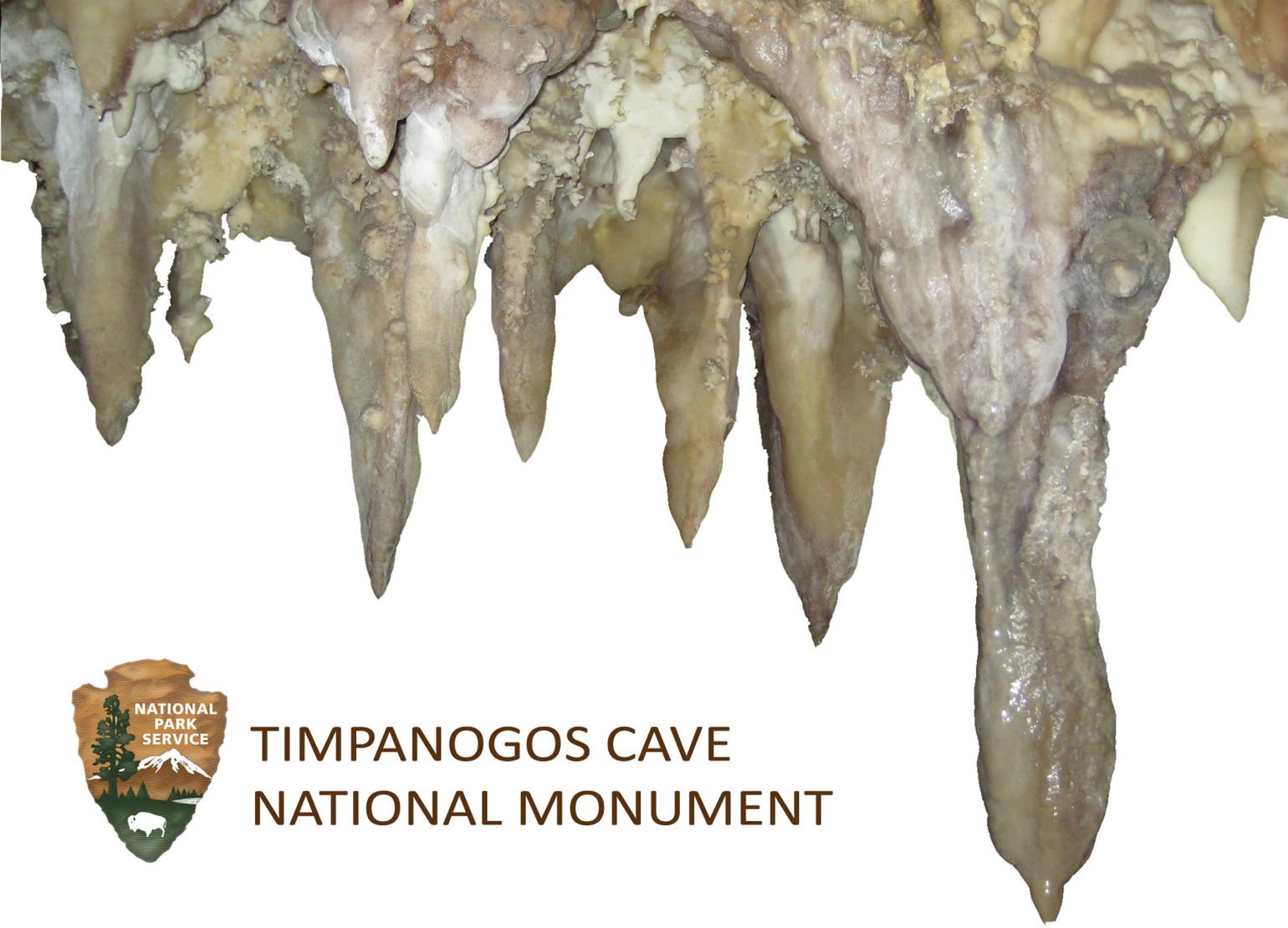
- b. Have all students use the restrooms at the Visitor Center before hiking up. There is one bathroom near the top of the trail, but it is much smaller. Still, plan on having all students use the restrooms once again near the cave entrance.

3. On the Trail

- a. We recommend having one adult at the front of each group of students and one adult in the back. The students usually have more energy than the adults and want to get ahead, but for safety purposes, the students must remain with their chaperones at all times. Students are not allowed to run ahead of the group, up or down the trail.
- b. Please keep the following items in mind as you hike the trail:
 - i. No Collecting: Everything in the Monument is protected. Students may not take home any plants, formations, sticks, or rocks from the monument. Hiking sticks are not allowed inside of the cave, so please don't let your students pick one up. Please do not have students bring hiking sticks from home.
 - ii. Don't Feed the Wildlife: Feeding wildlife can become a safety issue for the students. It also makes our wildlife sick and dependent upon humans.
 - iii. Don't Throw Rocks: Much of the trail has switchbacks below. Throwing rocks endangers everyone on the trail.
 - iv. No Running: This is one of our most common problems. The trail is very steep, and running is very dangerous.
 - v. Stay on the Trail: Please make sure that your students are not shortcutting or climbing on the rocks. They NEED to stay on the trail.
 - vi. Use the Restrooms: There is only one restroom at the top of the trail. This will be approximately an hour after you start up from the Visitor Center. It will be approximately another two hours before students will be able to use the restroom again, unless they want to hike two switchbacks back up to the restroom at the end of the tour. The cave is a cold, wet, drippy environment, so even if they don't think they have to go, you should strongly recommend they at least try. If restrooms are not used, it is uncomfortable for EVERYONE.
- c. The rangers in the visitor center will remind you of all of these things, but we wanted to reemphasize it in this packet.

4. In the Cave

- a. The cave is a delicate environment. Please remind your students of the following three things:
 - i. Don't Touch: The oils and dirt on our hands damage the cave when we touch. Just as you wouldn't hesitate to discipline your students in the classroom, please don't hesitate to discipline students in the fragile environment of the cave. Please remind your chaperones that discipline is also THEIR responsibility.
 - ii. No Eating or Drinking in the Cave: Finish your snacks BEFORE you come inside the cave, and please throw away your trash in the garbage.
 - iii. Backpacks: All backpacks, fanny packs, and hydration systems will be removed from the back during the cave tour. Most people switch them to the front. Students may practice this in class.



TIMPANOGOS CAVE
NATIONAL MONUMENT

Background Information

Teaching the Teacher



Aligned to 4th and 5th Grade
Utah State Educational
Standards

Background Information

Compiled by Wendy B. Smith and Anna Davis, 2009

I. Geology in the Timpanogos Cave System

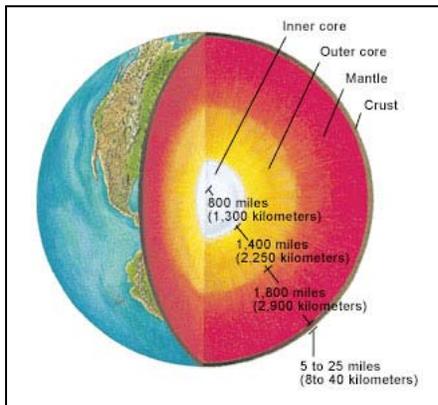
Utah 4th Grade Science Benchmark:

Earth materials include rocks, soils, water, and gases. Rock is composed of minerals. Earth materials change over time from one form to another. These changes require energy. Erosion is the movement of materials and weathering is the breakage of bedrock and larger rocks into smaller rocks and soil materials. Soil is continually being formed from weathered rock and plant remains. Soil contains many living organisms. Plants generally get water and minerals from soil.

Utah 5th Grade Science Benchmark:

The Earth's surface is constantly changing. Some changes happen very slowly over long periods of time, such as weathering, erosion, and uplift. Other changes happen abruptly, such as landslides, volcanic eruptions, and earthquakes. All around us, we see the visible effects of the building up and breaking down of the Earth's surface.

A. How the Earth Formed:

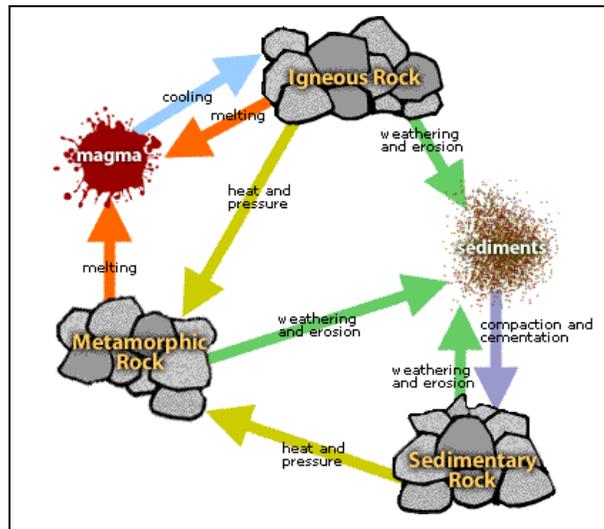


Most of what we know about the earth's history has been found through the study of rocks. Geologists use what they know to tell how old a rock is and what changes have happened in the rock over time. Most scientists agree that the earth is about 4.5 billion years old.

http://www.nasa.gov/images/content/103949main_earth10.jpg

http://www.nasa.gov/worldbook/earth_worldbook.html

B. The Geologic Cycle (Utah 4th Grade Science Standard III, Objective 1a, 1d)



<http://www.cotf.edu/ete/modules/mse/earthsysflr/rock.html>

C. Three Basic Rock Types (Utah 4th Grade Science Standard III, Objective 1a, 1d)

1. **Igneous Rocks** – These rocks came up from deep within the earth, often from volcanoes. Examples are basalt and obsidian.
2. **Sedimentary Rocks** - These are formed when other rocks, animal remains, and minerals are deposited in layers on top of each other. Examples are sandstone, limestone, and shale. All of the rocks along the trail and in the cave are sedimentary rocks. The cave was formed in limestone, a rock that was formed in the bottom of an inland sea.
3. **Metamorphic Rocks** - These are rocks that have been physically or chemically changed by tremendous heat and pressure inside the earth. Examples of these are marble and slate.

Rock type formation information, pictures & quiz: <http://www.fi.edu/fellows/payton/rocks/expert/>

D. Mountain Building (Utah 5th Grade Science Standard II, Objective 2c, 3; Utah 4th Grade Social Studies Standard I, Objective 1b, Objective 2a-c, Objective 3)

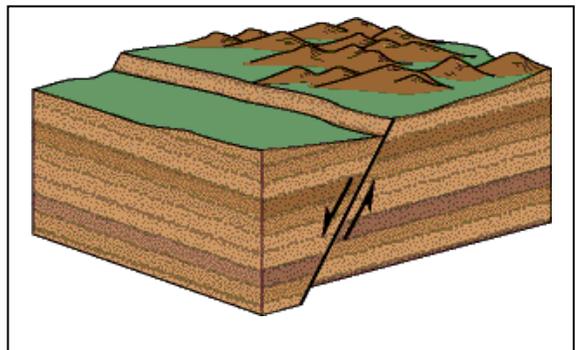
1. **Formative Processes** - erosion, glaciers, faulting, volcanic activity or a combination of processes

- a. **Uplift**- Mt. Timpanogos was created by huge masses of rock being pushed upwards by the Wasatch Fault.
- b. **Erosion** – The American Fork River cut deep canyons in these rock masses (erosion). A good way to help students understand uplift and erosion is to teach them that at one time parts of the American Fork River ran through the cave, carving it out. Between the uplift of Mt. Timpanogos and the down-cutting of the river, the cave is now over one thousand feet higher than the river.
- c. **Weathering**- Water seeps into cracks in the rocks. As this water freezes, it expands, opening up the crack. Over time, this process will cause rocks to separate completely, and fall down the canyon walls. Avalanches, rockslides, animals, and people can also cause rocks to slide down the mountain.
- d. **Timeline** - The process of rising blocks and eroding canyons took millions of years. For example, the Deseret Limestone in which the cave is located is estimated to be 340- 350 million years old.

2. **Fault** - A crack along which rock moves.

- a. **Earthquakes** – The earth trembles when pressure is suddenly released along one side of the fault lines. An earthquake broke off some stalactites along the fault line in Middle Cave Lake. *2

*Numbers in boxes correlate with a map of the cave in the back of the packet.



<http://www.windows.ucar.edu/tour/link=/earth/geology/fault.html>

b. **Faults and Cave Formation** – The cave was formed along the fault because that was where water came in. Water, like people, will take the path of least resistance. It would rather travel through a crack than through solid rock. On the cave tour, students will have the opportunity to walk through some fault lines and actually see where the crack comes together. Students can also notice that the caves seem to be formed along a straight line. This is because they were formed along the fault.

c. **Timpanogos Cave Faults**- There are five faults in the Timpanogos Cave system. The most famous three are named after the caves:

i. Hansen Cave Fault

ii. Middle Cave Fault

*3

iii. Timpanogos Cave Fault

*7



3. Limestone and Caves

a. **Why Limestone?** Most caves are found in limestone because it is a softer rock that is easy to dissolve. Timpanogos Cave is located in Desert Limestone. Caves are the plumbing of the earth. Huge amounts of water are found underground in caves, underground rivers, and aquifers.

b. **Limestone Formation**- Shells of marine animals and sediments build up at the bottom of seas. Over millions of years, these sediments form thick layers. As these layers dry and harden, they form limestone.

c. **Fossils**– Because limestone is the remains of an ancient sea bed, many fossils of plants and animals can still be seen in the rock. A good example of a coral fossil is found outside of the entrance where you wait for the tours and also inside of Hansen Cave. You may also encourage your students to look for examples of fossils in the rocks up and down the trail. (**Utah^{4th} Grade Science Standard IV, Objectives 1 & 2**)



d. **Cave Size**

1. Mammoth Cave in Kentucky is the longest known cave in the world with over 330 miles of mapped passages. There are many caves that students may have visited in the National Park System.

2. The Timpanogos Cave system is actually made up of three medium-sized caves: Hansen Cave, Middle Cave, and Timpanogos Cave. Visitors walk through all three on a trail that is about a ½ mile long.

II. Hydrology - Water Cycle in the Timpanogos Cave System

Utah 4th Grade Science Benchmark:

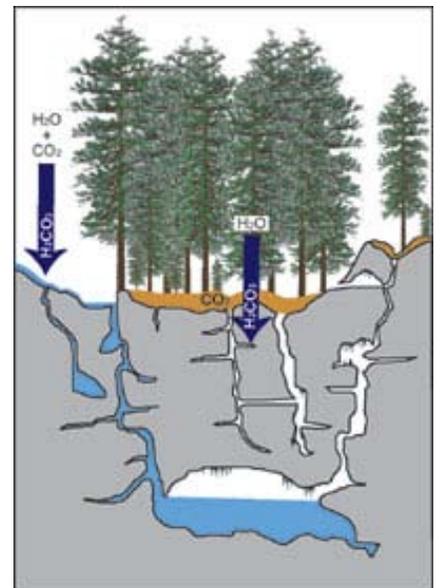
Matter on Earth cycles from one form to another. The cycling of matter on Earth requires energy. The cycling of water is an example of this process. The sun is the source of energy for the water cycle. Water changes state as it cycles between the atmosphere, land, and bodies of water on earth.

A. The Creation of the Cave (Utah 5th Grade Science Standard II, Objective 1b; Utah 4th Grade Science Standard I, Objective 1a, 2c)

1. **Carbonic Acid-** As the rain water soaks into the upper layers of the soil, it passes through a layer of decaying plants and animal material which is rich in carbon dioxide. (Smaller amounts of CO₂ are also collected from the air and snow.) This carbon dioxide combines with the water to form a weak acid called carbonic acid.

2. **A Cave is Born-** This acidic water (carbonic acid) flows down through the cracks in the limestone, dissolving the rock along the way. That's how the hole (the cave) was made in the first place. The hole was then possibly enlarged by other factors such as geothermal waters rising from below or groundwater running inside of the cave.

3. **Filling the Cave In-** While the water is coming through the rock, it is also dissolving and picking up a mineral called calcite (calcium carbonate). It carries this calcite with it until it finds a space large enough to precipitate (leave it behind). As it comes into the hole, with each drip of water, it leaves traces of that calcite behind as different cave formations.



http://www.esi.utexas.edu/outreach/caves/images/caves/caves_fig1.jpg

B. Water Tables and Timpanogos Cave (Utah 4th Grade Science Standard I, Objective 2c, 2e)

1. When the cave first started forming, it was underneath the water table. However, as the mountain was uplifted and the river eroded the canyon, the cave was raised up to the level of the river.

2. For a time, parts (or possibly all?) of the American Fork River actually ran through the cave. As this flowing water ran through, it was able to enlarge the cave much faster than the carbonic acid. Many interesting shapes in the cave were carved out of the soft rock by this flowing water.

3. As the uplift and erosion continued, eventually the cave was pushed higher and higher above the water table and level of the river. In the air-filled pockets of the cave, the water coming in then started to create cave formations. Now, instead of water working to dissolve and carve out the cave, water is working to fill the cave back in.

C. Cave Formations-



1. Process of Formation

- a. Water seeping through the soil and rock into the cave becomes saturated with dissolved calcite.
- b. When the water reaches the open space of the cave, carbon dioxide escapes into the air.
(like the carbon dioxide that escapes from a bottle of soda pop when it is opened)
- c. When the carbon dioxide is released the water cannot hold the calcite
- d. The calcite drops out of the water (precipitates) and is deposited on the cave ceiling, walls, and floor.



2. Types of Cave Formations (For color examples see Cave Glossary)-

a. Soda Straw: As water comes down through the rock and forms a drop, the calcite forms in a ring around the outside of the drop. With each drip, the straw gets longer. As indicated by the name, soda straws are hollow inside. When the straw gets plugged up, the water runs along the outside, beginning a stalactite. Soda straws are baby stalactites.

*6 (Chimes Chamber)



b. Stalactites and Stalagmites: If you are quiet in the cave, one of the only sounds you will hear is the sound of dripping water. This dripping is slowly building stalactites and stalagmites. Remember when the water enters the cave it begins to lose its ability to hold the calcite. As a drop forms on the cave ceiling, it deposits a small amount of calcite before dripping to the floor. The drips on the floor accumulate into a pile of calcite known as a stalagmite.

*2 (Middle Cave Lake)

*5 (Heart of Timpanogos Cave)



c. Flowstone: Flowstone is formed when water runs in a sheet over the surface of the cave walls leaving a smooth or gently rippling coat of calcite. This formation often looks like a frozen waterfall.

*1(Hansen Cave)

**All through the caves

d. Drapery/ Bacon: Have you every washed your face and had water drops run down your arms? Sometimes the water runs down a sloping ceiling and forms a path. When this happens, a thin layer or fin of calcite is formed that resembles a drapery.

*6 (Chimes Chamber)

e. *Rimstone*: If the water drips into a pool of water, the calcite floats along the top of the water and gradually attaches to the side. This rimstone formed can be compared to a thousand-year ring-around-the-bathtub.

*4 (Coral Garden)

f. *Popcorn*: Sometimes the water seeps through the cave wall in such small amounts that drops do not form. The water seeps through the wall similar to water seeping out of our skin like sweat. In this case the calcite is deposited in a lumpy formation known as popcorn.

*3 (Middle Cave Fault)



g. *Helictites*: Sometimes instead of forming popcorn, the calcite grows into tiny, twisted fingers called helictites. In most caves helictites are relatively rare formations, but in Timpanogos Cave there are literally thousands of them. This is one of the features that makes Timpanogos Cave distinctive.

*4 (Coral Garden)

*5 (Heart of Timpanogos Cave)

3. Colors of Cave Formations

The variety of colors in Timpanogos Cave is another distinctive feature. Calcite, the basic mineral in cave decorations, is almost pure white. Its main element, Calcium, is the same thing that makes our teeth and bones white, too. Different colors found in the cave are due to other minerals mixing with the calcite.

The colors found in Timpanogos Cave are:

| Color: | Mineral: |
|---------------------------------------|---------------------|
| Brown, red, orange..... | Iron Oxide (rust) |
| Yellow..... | Nickel in Calcite |
| Lime green..... | Nickel in Aragonite |
| Black, Bluish-gray, Purple, Pink..... | Manganese |



*7 (look for these colors at Caramel Falls in Timpanogos Cave)



*5 (look for this green color near the Great Heart of Timpanogos Cave)

(Aragonite is a *polymorph* of calcite, which means that it has the same chemistry as calcite, but it has a different structure, and more importantly, different symmetry and crystal shapes.)

III. Meteorology – weather in the Timpanogos Cave System

A. Cave Weather (Utah 4th Grade Science Standard II, Objective 2a)

1. **Temperature:** The cave temperature remains near 45 F (7.2 C) all year. This is about the same temperature as in your refrigerator. The temperature inside the cave is the average annual temperature outside of the cave. This is the same for any cave. If you found the average of the high and low for each day and then found the average temperature for every day of the year, that would be the temperature of the cave.
2. **Insulation:** Because the thick layer of rock between the cave and the outside of the mountain acts as insulation, the temperature in the cave does not change rapidly.
3. **Humidity:** The cave has 100% humidity. You might get a drop of water on your head. We call that a cave kiss.

4th Grade Science Benchmark

Utah has diverse plant and animal life that is adapted to and interacts in areas that can be described as wetlands, forests, and deserts. The characteristics of the wetlands, forests, and deserts influence which plants and animals survive best there. Living and nonliving things in these areas are classified based on physical features.

IV. Biology in the Timpanogos Cave System

A. Cave Animals – an occasional bat near an entrance and several types of insects (Utah 4th Grade Science Standard 5, Objective 2b)

1. **Bats-** We have several species of bats that visit Timpanogos Cave. However, they are nocturnal, and they don't like noise or light, so we don't usually see them on a cave tour. If you get to see one, you are lucky.



Townsend's Big-Eared Bat



Cave Cricket

2. **Cave Crickets-** One familiar insect in the cave is the cave cricket. Cave crickets have a lighter coloring due to lack of natural light. They also have long antennae that help them feel their way around in the dark. You would also be lucky to see a cave cricket on the tour.

V. History of the Timpanogos Cave System

(Utah 4th Grade Social Studies Standard I, Objective 2 a-c, Objective 3 a-c)

A. Hansen Cave

a. **Discovery of Hansen Cave, Fall of 1887-** One day Martin Hansen was cutting wood and saw cougar tracks. He followed these tracks up the side of the canyon until they led him to the entrance of Hansen Cave. This initial discovery led to the discoveries of the other two caves.

b. **Tours of Hansen Cave by Martin Hansen, 1888-1891-** When Hansen discovered this beautiful cave, he decided to show it off and lead people through it. He constructed a rudimentary trail, often using tree ladders to go up the sides of cliffs. Many of these earlier visitors even broke off formations as souvenirs. Today we must remember that this was a different time with different mindsets, and these visitors did not have the same view of conservation we have today.

c. **Duke Onyx Mining Company, 1892-1893-** The Duke Onyx Mining Company came from Chicago, Illinois looking for onyx. Onyx was used as a decorative stone in furniture, counter tops, mantle pieces, etc., and onyx was often found in caves. Miners brought in their chisels and wedges and took out approximately 2 train-car loads. Later, it was discovered that the cave formations were not onyx after all, but a much softer mineral called calcite.



B. Timpanogos Cave

a. **Discovery of Timpanogos Cave, Summer of 1913-** Two teenage boys, James Gough and Frank Johnson, came up with their families to explore Hansen Cave and decided to do some more exploring on their own. They slid down a slope near Hansen Cave and discovered the entrance of Timpanogos Cave. These boys wanted to keep it a secret and make it their own. They actually filed a mining claim on the land (although they never really mined anything), and then moved away. Only a few friends even knew the cave had been discovered.

b. **Rediscovery of Timpanogos Cave, August, 1921-** After hearing rumors of a mystery cave, Vearl Manwill and a few friends in the Payson Alpine Club combed the area around the caves looking for an entrance. Manwill made the “rediscovery,” and made contact with the Forest Service about its whereabouts.

C. Middle Cave

- a. **Discovery of Middle Cave, October 1921-** Two deer hunters on the opposite side of the canyon were looking across at the entrance of Hansen Cave and discovered another opening between the other two entrances. These two men, George Heber and Wayne Hansen, were the son and grandson of Martin Hansen. They decided to check it out, but didn't have enough light, so they had to come back later more prepared. The entrance to Middle Cave was approximately 110 feet above the floor, so entering the cave required ropes and climbing.

D. Timpanogos Caves Becomes a National Monument

- a. **Timpanogos Cave Committee-** Because the caves were on Forest Service Land, the Forest Service was in charge of the cave's protection and administration. However, because they didn't have the funds, a Timpanogos Cave Committee was formed to raise money, put in a lighting system, build a trail, and lead cave



tours. The first cave tours were in 1922. Thousands of people came through the caves and saw how beautiful and spectacular they were. The relatively untouched formations of Timpanogos seemed a sharp contrast to the mining and other damages found in Hansen Cave. As the community came up to see the caves, they began to care about them as well.

(They had the same experience that we hope you and your students will have when you come on your fieldtrip.)

- b. **Miners Threaten the Cave-** In 1920, a year before Timpanogos and Middle Caves were discovered, some miners filed three claims in the area, one of which overlapped with the cave. The miners ordered the rangers hired to protect the cave to vacate the premise. It is not known if these men really would have mined in the cave; however, at that time the threat was very real. These miners later fought the monument designation in 1922.
- c. **Timpanogos Caves Becomes a National Monument-** On September 15, 1922, Regional Forester R. H. Ruthledge wrote to Washington, D.C. requesting that the caves become protected as a National Monument. On October 14, 1922, President Warren G. Harding used the Antiquities Act of 1906 to set the caves aside because it, "...is of unusual scientific interest and importance."
- d. **Lessons for Today-** As the community of the early 1920s learned about the caves, they wanted to protect them. Their speedy action preserved the caves so

that now, nearly 90 years later, we can still enjoy the beautiful formations and interesting geology. Mining has been a very important part of Utah history, and it has contributed greatly to our economy and culture. However, the formations in Timpanogos Cave are not judged today by how much money they are worth. The formations in the caves are valued today for their beauty, scientific interest, and their use as a resource to teach others.

- e. **The Importance of You, the Teacher-** At Timpanogos Cave National Monument, we have a wonderful opportunity to educate people about caves, geology, hydrology, history, and ecology. It is magical for students to come into the cave and see firsthand the principles that they have been learning about in the classroom. We STRONGLY encourage you to teach the standards in the core curriculum and utilize the resources in this packet PRIOR to your visit.
- f. **Help Us Protect the Caves Today-** We owe much to the early visitors who protected the caves so that we can enjoy them today. On the cave tours, we ask students not to touch the formations, although it is incredibly tempting. The oils and dirt on our hands will permanently stain the formations and also prevent future growth. We ask that students do not break or take anything, and we ask that students don't eat or drink anything inside of the caves. Although these may seem like small things to do, your students can gain a feeling of love, ownership, and protection towards the caves just as much as the early visitors



did back in the 1920s. As students learn about the caves, they will grow to love the caves; and as they grow to love the caves, they will naturally want to protect them.

Enjoy your visit to Timpanogos Cave.

Cave Glossary

| | |
|---|---|
|  | <p>Aragonite – form of calcium carbonate that makes up some cave formations. It has a more delicate, needle-like crystal structure that makes frostwork. Nickel in aragonite is green.</p> |
|  | <p>Calcite – form of calcium carbonate that makes up cave formations. Its color is pure white, but if minerals are mixed in, it will pick up different colors. It is brought in by water and deposited in the cave.</p> |
| CaCO_3 | <p>Calcium carbonate – CaCO_3. Compound that makes up limestone, calcite, and aragonite. These rocks are made up of the same atoms, they are just put together differently. (Difference in crystal structure).</p> |
|  | <p>Capillary action – a process that allows water to be pulled from a wet area into a dry area. This is how helictites are formed. This also is the way plants get water up to the leaves from their roots.</p> |
| CO_2 | <p>Carbon dioxide – naturally occurring gas in the atmosphere. When mixed with water, it forms carbonic acid.</p> |
| $\text{H}_2\text{O} + \text{CO}_2 = \text{H}_2\text{CO}_3$ | <p>Carbonic acid – a weak acid made up of carbon dioxide and water. Dissolves limestone to form a cave.</p> |

| | |
|---|--|
|  | <p>Cave bacon – cave formation that is made when water repeatedly drips down an inclined plane.</p> |
|  | <p>Column – cave formation made when a stalactite and stalagmite meet.</p> |
|  | <p>Fault – a crack in the earth’s surface where plates move. Earthquakes often happen along faults. Along this fault, water comes in from the outside to help form caves.</p> |
|  | <p>Flowstone – cave formation made when water flows down a wall. Looks like a frozen waterfall.</p> |
|  | <p>Fossil – evidence of an ancient form of life found in sedimentary rocks.</p> |
|  | <p>Groundwater – water that flows under the earth surface. It comes from rain and snow and seeps into the rocks and soil.</p> |
|  | <p>Helictites –cave formation made from seeping water that twist all directions. They are formed by capillary action so they seem to defy gravity. In most caves helictites are relatively rare formations, but in Timpanogos Cave there are literally thousands of them.</p> |



Karst – A type of landscape where caves are common. The land has different sized blocks of limestone. These fractures are where the water seeps in, dissolves the stone, and forms caves.



Limestone – gray sedimentary rock made of calcium carbonate. It is the ancient sediments left behind in bodies of water and often contains fossils. When carbonic acid dissolves this rock, caves are formed.



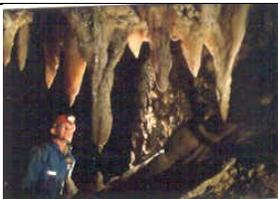
Cave popcorn – cave formation made when water seeps or splashes out from the limestone rock.



Shelfstone – cave formation made when calcite forms around the edge of a pool of water.



Soda straws –formed when water drops and makes a ring of calcite around the edge of the drop. With each drop the rings grow longer to form a hollow tube.



Speleology – the study of caves



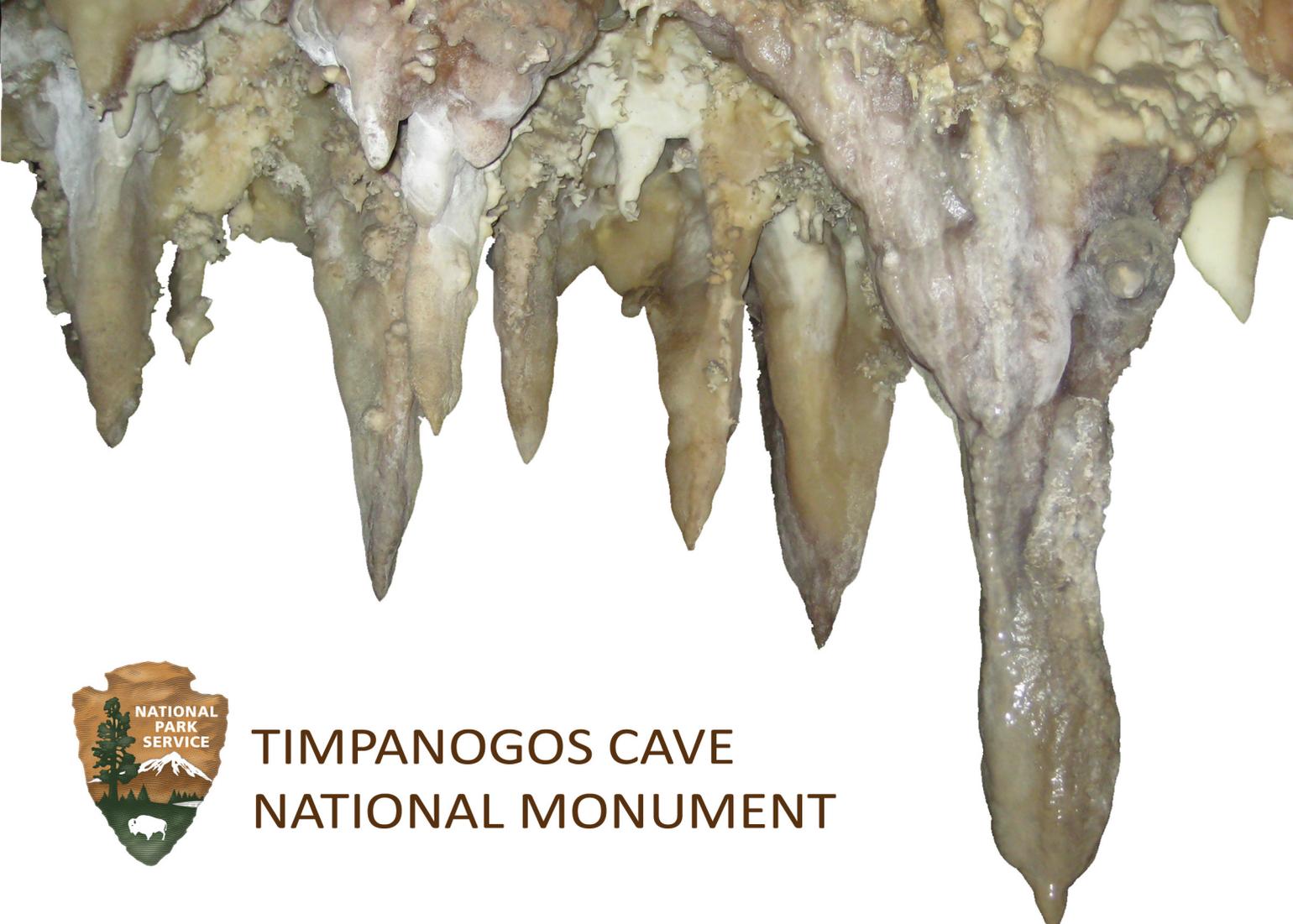
Stalactite – cave formation that hangs from the ceiling. (It *holds tight* to the Ceiling) As water drips from the top, it leaves behind a trace of calcite.



Stalagmite – Pile of calcite formed when water drips onto the ground. (You *might* trip on it on the Ground). Often found below stalactites, but can be formed below **any** type of dripping water.



1. Hansen Cave
2. Middle Cave Lake
3. Middle Cave Fault
4. Coral Gardens
5. Heart of Timpanogos
6. Chimes Chamber
7. Caramel Falls



TIMPANOGOS CAVE
NATIONAL MONUMENT

Lessons and Activities

Pre-Visit Assessments and Activities

Appendix A



Aligned to 4th and 5th Grade
Utah State Educational
Standards

Timpanogos Cave National Monument Pre-assessment



What do you know about caves?

What do you want to know about caves?

What did you learn about caves?

What do you know about caves?

How is making a cave like making cookies?

Diantha Smith and Anna Davis, 2009

If you were making sugar cookies, you would gather up all the ingredients, mix them together and bake them in the oven. Caves also have a recipe, but it takes much longer to make a cave.

The two main ingredients in Timpanogos Cave are **limestone** and **water**. The limestone in Timpanogos Cave is full of fossils of sea creatures. The fossils tell us that the limestone was deposited layer by layer in an ancient sea bed. After millions of years, the land shifted northward and the ocean on top of the limestone drained away.

When the land shifted, cracks were made in the rock. These cracks, or **faults**, are another important cave ingredient. They created openings for water to come through.

As rain and snowmelt crept down through the rocks and soil, they picked up carbon dioxide. When water and carbon dioxide mix, they make a very important cave ingredient called **carbonic acid**. When Timpanogos Cave was first formed, carbonic acid dissolved limestone and left holes in the rock. Later, the holes were widened by ground water and the American Fork River.

We're not sure how long the river carved out the cave. But as pressure built up along the fault lines, the mountains and cave were pushed higher and higher while the river cut lower and lower. Water starts mixing up the cave in a new way. Now, instead of

making holes in the rocks, water starts to fill them in.

Cave formations are a lot like icing on top of sugar cookies. They come in many shapes and colors. The formations are made of calcite. The calcite is picked up when carbonic acid dissolves limestone. Then, water carries the calcite down into the cave. When water drips, the calcite makes stalactites, stalagmites and columns. When water flows down the cave walls it makes flowstone or cave bacon. If the water seeps through the walls, like sweat on our skin, it forms cave popcorn and helictites. Sometimes the water also carries other minerals with the calcite. They act like food coloring in frosting. For example, Nickel can change the color to yellow or green. Iron can make formations orange or reddish brown. If

the water changes paths and picks up new minerals, one formation can have more than one color. It's like dipping your knife in many colors of frosting to put on the top of the same cookie.

Eventually the cave, just like the cookies, will have an end. Cookies fill stomachs and calcite fills caves. Fortunately, it takes a lot longer to fill a cave than a hungry person. Most cave formations grow less than 1 mm a year, so the cave has a long time to keep cooking.



The Great Heart

Type: Stalactite

Height: 5 ½ feet

Weight: 4,000 pounds

Formed by: dripping
water

Kinds of Caves:

Sea Cave- formed on the coast
by waves

Lava Cave- formed by a stream
of lava

Talus Cave- formed among a
group of boulders

Solution Cave- formed when a
weak acid dissolves rock

Cave Records:

Deepest- Krubera-Voronja Cave,
7,188 ft deep, Abkhazia,
Republic of Georgia

Biggest Chamber- Sarawak Chamber,
big enough to hold 10 jumbo jets, Island
of Borneo, Malaysia

Longest- Mammoth Cave, 367 miles,
Kentucky, USA

Cave Dangers:

Hypothermia- body gets too cold

Getting Lost- this can lead to starvation or
hypothermia

Poisonous Gases- carbon dioxide gets trapped
underground and can kill you

Falling/Getting Stuck: in uncharted caves it is easy
to get hurt this way

Troglobites- NOT! These mostly blind and
colorless creatures are harmless.

Name: _____



Graphic Organizer: Compare and Contrast

Sugar Cookies

Timpanogos Cave

ALIKE

DIFFERENT

DIFFERENT

Name: _____

Reading Comprehension: What do you know about caves?

Context Clues: Use what you read to help you match each word with the correct definition.

Limestone:

A crack in the earth's surface where two sections of rock have shifted.

Fault:

A mineral made up of calcium carbonate (CaCO₃) or dissolved limestone.

Carbonic Acid:

A sedimentary rock mostly made up of the remains of marine animals.

Calcite:

A combination of water and carbon dioxide that can dissolve limestone.

Write four cool facts you found in the text boxes in your own words:

1. _____

2. _____

3. _____

4. _____

Underline the sentences that are an opinion.

1. Timpanogos Cave is the most beautiful cave in the United States.
2. Nickel is the mineral that makes formations turn yellow or green.
3. The fossils in the cave are older than dinosaurs.
4. Learning about caves is very interesting.

Name: _____

Cave Recipes:

Cave Recipe
Mix ancient sea bed and time to make _____.

Cave Recipe
Mix faults and _____ to make holes in limestone.

Cave Recipe
Mix water and _____ to make carbonic acid.

Cave Recipe
Mix water and _____ to make cave formations.

Cave Recipe
Mix calcite and nickel to make _____.

Cave Recipe
Mix _____ water and calcite to make flowstone & bacon.

Cave Recipe
Mix calcite and _____ to make orange or brown color.

Cave Recipe
Mix _____ water and calcite to make stalactites, stalagmites and columns.

Cave Recipe
Mix faults, rocks, and _____ to make mountains.

Cave Recipe
Mix _____ water and calcite to make popcorn and helictites.

Recipe Words:
yellow pressure seeping calcite dripping carbon dioxide
limestone carbonic acid flowing iron



Name: _____



Graphic Organizer: Compare and Contrast **ANSWERS**

Sugar Cookies

Timpanogos Cave

ALIKE

have a recipe

many ingredients

formations = frosting

food coloring = minerals (nickel & iron)

DIFFERENT

Short time to make

Mostly sugar & flour

Cookies end up in stomachs

Can eat

DIFFERENT

Long time to make

Mostly limestone & water

Caves can fill up with calcite

Can't eat, but can explore

Name: _____

Reading Comprehension: What do you know about caves? **ANSWERS**

Context Clues: Use what you read to help you match each word with the correct definition.

Limestone:

A crack in the earth's surface where two sections of rock have shifted.

Fault:

A mineral made up of calcium carbonate (CaCO₃) or dissolved limestone.

Carbonic Acid:

A sedimentary rock mostly made up of the remains of marine animals.

Calcite:

A combination of water and carbon dioxide that can dissolve limestone.

Write four cool facts you found in the text boxes in your own words:

1. *Answers will vary.*

2.

3.

4.

Underline the sentences that are an opinion.

1. Timpanogos Cave is the most beautiful cave in the United States.
2. Nickel is the mineral that makes formations turn yellow or green.
3. The fossils in the cave are older than dinosaurs.
4. Learning about caves is very interesting.

Name: _____

Cave Recipes: **ANSWERS**

Cave Recipe

Mix ancient sea bed and time to make limestone.

Cave Recipe

Mix faults and carbonic acid to make holes in limestone.

Cave Recipe

Mix water and carbon dioxide to make carbonic acid.

Cave Recipe

Mix water and calcite to make cave formations.

Cave Recipe

Mix calcite and nickel to make yellow color.

Cave Recipe

Mix flowing water and calcite to make flowstone & bacon.

Cave Recipe

Mix calcite and iron to make orange or brown color.

Cave Recipe

Mix dripping water and calcite to make stalactites, stalagmites and columns.

Cave Recipe

Mix faults, rocks and pressure to make mountains.

Cave Recipe

Mix seeping water and calcite to make popcorn and helictites.

Recipe Words:

yellow pressure seeping calcite dripping carbon dioxide

limestone carbonic acid flowing iron



Reader's Theater By: Diantha Smith, 2009



CAVE CASE: Molly Cule vs. Rocky Stone

Characters:

Reporter (Narrator)

Molly Cule

Judge Geo

Water molecules (small group)

Rocky Stone

Rocks & Minerals (small group)

Reporter: Hello ladies and gentlemen. I'm Pat Spelunker. Today our story comes to you from a famous National Monument in Utah. I have an exclusive interview with Molly Cule and Rocky Stone at Timpanogos Cave. A crowd of supporters is also here, trying to let everyone know who they think is the best in the cave.

Water molecules (arms make waving motion): WA-ter! WA-ter!

Rocks and Minerals (fists pump up in the air): Rocks rock! Rocks rock!

Reporter: Both Molly and Rocky think they should be the head honcho in Timpanogos Cave, and both have made their case to Judge Geo. After my interview, we hope to hear the judge's final decision. While we wait, I'll ask a few questions. Let's start with Molly. Can you tell us why you should rule the cave?

Molly: That's easy. The cave is full of fossils of sea creatures that lived in ... WATER. Obviously! About 350 million years ago, Utah was part of a huge inland sea. Limestone formed on the bottom of that sea. Without water, the rocks and the cave wouldn't even be here.

Reporter: Interesting. Rocky, what do you say?

Rocky: Well Pat, as you know I represent all the limestone, calcite and other minerals in the caves. It was the faults that pushed the rock OUT of the sea and all the way up north here to Utah. The big faults pushing the rocks against each other made smaller faults like the ones in the caves. Without those cracks in the rock, water couldn't even get in to make a cave.

Reporter: I see your point. Timpanogos Cave has five fault lines, and they do make a big difference.

Molly: Excuse me, but the faults would mean nothing without water.

Reporter: Really? Tell us more, Molly.

Molly: Water is responsible for opening up the cave in the first place. Water and carbon dioxide mix together to make carbonic acid, and this is what dissolved out the hole in the rock. Also, at one point large amounts of underground water came pouring through Timpanogos Cave. The river in American Fork Canyon even carved out parts of the cave. I mean, what is a cave? A hole in the rock. And what made that hole? Water.

Water molecules (arms make waving motion): WA-ter! WA-ter!

Rocks and Minerals (fists pump up in the air): Rocks rock! Rocks rock!

Judge Geo: Order in the court!

Reporter: Thank you judge. You've made an important argument, Molly. How do you respond to that, Rocky?

Rocky: Well, Molly and her little H₂O friends may have widened the cave, but rock is making a comeback. Now that Timpanogos Cave has been pushed over 1,000 feet ABOVE the river, calcite formations are growing all over the cave. Give us another couple of million years and we may just fill it up completely.

Molly: Ha! Calcite is only in the cave today because water picked it up from the limestone and re-deposited it on the walls of the cave.

Rocky: But calcite is still a mineral! You just move it around.

Molly: Move it around? When water paints calcite on top of old gray limestone, it becomes beautiful stalactites, helictites, and other cave formations. Water makes the cave look amazing. Just think of it as free plastic surgery.

Rocky: You want surgery? How about we dam up the river with a rock slide?

Reporter: All right guys. Let's not get all steamed up. We know water makes the formations grow and gives them their interesting shapes. Let's give Rocky a chance to tell us more about how rocks and minerals help with decoration.

Rocky: Thank you Pat. Water may shape the rocks, but minerals make their awesome colors. If you are in Timpanogos Cave and you see yellow or green, nickel is responsible. If you see browns, reds or oranges, iron oxide made it that way. The minerals are the wall paints that decorate the cave so nicely.

Molly: Yes, the minerals are important, but they would never get mixed into the calcite without water.

Rocky: Here we go again.

Molly: Well it's true! Water does all the work. H₂O is the artist of the cave. We widen it AND we make it beautiful. Water is what makes all the choices, the rock is just what gets left behind.

Rocky: Okay, water is like the artist. But what good is an artist without paint or a canvas? Rocks and minerals are the tools. Without us you could never create any kind of cave.

Judge Geo: That's enough! It's time for me to announce my decision.

Reporter: I think we've heard good arguments from both sides. This is going to be one tough decision. Are you sure you don't need more time, Judge Geo?

(Take a break and do the graphic organizer.)

Judge Geo: I don't need any more time, I'm ready. I've done a lot of research on this case, and I am sure I know who the real ruler of the cave is.

Water molecules (arms make waving motion): WA-ter! WA-ter!

Rocks and Minerals (fists pump up in the air): Rocks rock! Rocks rock!

Judge Geo: Order in the court! Thank you. No one can say that rocks and minerals aren't important to a cave, but water is essential, too. Limestone is the foundation of the cave, but water opened it up through fault lines. All the beautiful formations in the cave are made of calcite and other minerals, but they could have never existed without the power of water.

Rocky: So...neither of us is the ruler? You've got to be kidding!

Molly: I demand a new hearing!

Judge Geo: Let me finish. Neither rock nor water can be the ruler of a cave by themselves. Therefore, they must rule the cave *together*. I declare both Rocky Stone and Molly Cule co-rulers of Timpanogos Cave!

Water molecules AND Rocks and Minerals: Yeah! (clapping and cheers)

Rocky: Well, if I have to rule with someone, at least it's someone as powerful as water. How about it Molly?

Molly: You may be rough around the edges Rocky, but you're also solid and steady. Together we can keep the cave going for years to come.

Water Molecules AND Rocks and Minerals: Rocks and wa-ter! Rocks and wa-ter!

Reporter: Well, there you have it folks. In a surprise decision Judge Geo has decided that the caves can't be ruled by either Molly or Rocky alone. Water and rocks both have to work together for caves to exist. Next time, join me as we find out how exactly Timpanogos Cave got so high in the mountains. Until then, I'm Pat Spelunker. Good evening and good luck.

THE END

Name: _____

Graphic Organizer: WHO RULES THE CAVE?

Directions: Fill in the t-chart and show evidence for the importance of both water and rock in a cave. Then decide which one you think should rule Timpanogos Cave.

Molly Cule

(represents water in all forms: rain, snow, rivers, glaciers, etc.)

Rocky Stone

(represents limestone, calcite, minerals and all other rocks in the canyon)

Name: _____ **ANSWERS**

Graphic Organizer: WHO RULES THE CAVE?

Directions: Fill in the t-chart and show evidence for the importance of both water and rock in a cave. Then decide which one you think should rule Timpanogos Cave.

Molly Cule

(represents water in all forms: rain, snow, rivers, glaciers, etc.)

Rocky Stone

(represents limestone, calcite, minerals and all other rocks in the canyon)

Answers will vary.

An inland sea helped form limestone

Water opens up the cave along fault lines (underground water and river water)

Water and carbon dioxide make carbonic acid which dissolved out the cave

Water brings calcite into the cave

Water coming in different ways makes different formations

Water carries colorful minerals in with the calcite

Water is the artist

Water is the verb

Answers will vary.

The cave is made of limestone, calcite and minerals

Faults in the rock let the water in

Faults push the mountains higher (uplift) raising the cave above the river

Calcite may fill up the cave one day

Minerals add color (nickel-green/yellow, iron oxide-orange/brown)

Minerals/rocks are the paint and the canvas. They are the tools that water works with.

Rock is the noun

Make Stalactites and Stalagmites

From: <http://www.hometrainingtools.com/article.asp?ai=1265&bhcd2=1247010587>



Caves are full of mineral deposits that form unique shapes, such as the icicle-like stalactites (which hang from the ceiling) and stalagmites (which rise up from the ground). (To learn more about cave rock formations, go to our [Stalactites, Stalagmites, & Other Cave Formations](#) Teaching Tip.) Make your own stalactites and stalagmites with this project! (Adult supervision recommended.)

Materials:

- **String**
- **Epsom salts**
- Baking soda
- Metal **washers**
- Four small glass jars or **beakers**

What to do:

1. Cut two 24" pieces of cotton string or wool yarn, and tie one metal washer to each end to act as a weight.
2. Fill four small glass jars or beakers 2/3 full with very warm (120-140 °F) water. Stir in as much baking soda into two of the jars as will dissolve; do the same with Epsom salt in the other two jars. Put the jars in a warm place where they can sit undisturbed for about a week.
3. Next, place a small plate between each set of jars and put the ends of one string in the baking soda jars with the middle of the string draping in a "u" shape just above the plate. Do the same with the Epsom salt.

After a few days, check to see if any material has built up on the string. An icicle-like formation should form downward on the string and upward on the plate. Real stalagmites and stalactites are formed in almost the same way, by mineral-containing waters dripping in caves until a deposit of calcium carbonate builds up...or down, as the case may be.

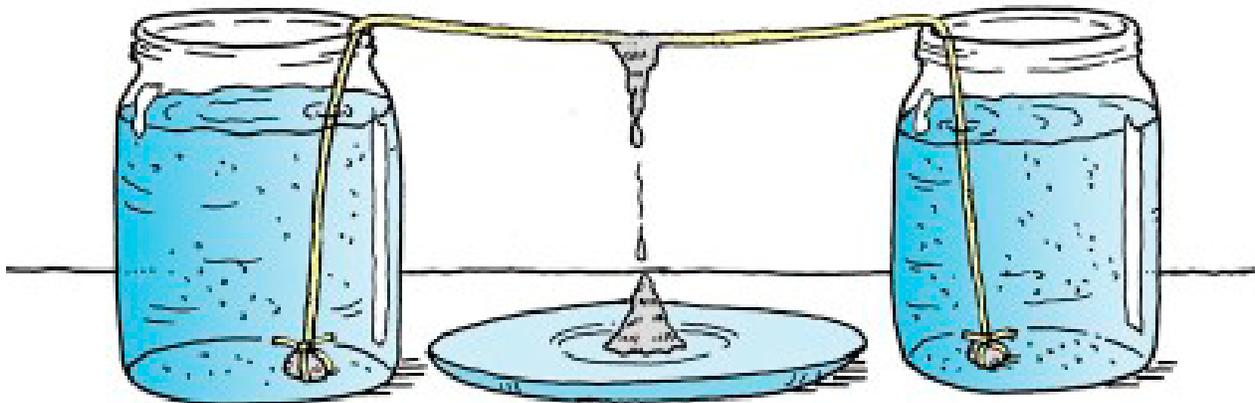


Image- <http://static.howstuffworks.com/gif/science-experiments-for-kids-14.jpg>

Timpanogos Cave Field Trip Preparation Sheet

Name: _____

Everything you need to know for a perfect visit.

What to bring on your hike:

- _____ (at least one full bottle).
- **Good** _____ (tennis shoes or hiking boots).
- **A light** _____ **or sweater** for the inside of the cave. Cave temperature is in the low 40's, the same as a refrigerator.
- **Sunscreen and/or a** _____

Trail Safety

- **Never** _____ **on the trail.**
 - You could trip and fall or start a rock fall.
 - You could run into someone else and cause them to get hurt.
- **Stay with your** _____.
 - No one under 16 is allowed to hike alone.
- **Stay on the** _____.
 - The trail is very steep and many rattlesnakes are impossible to see until you are right on top of them.
 - Be sure to not to stop in the red stripe zones, wait to rest in safer areas.
- **Be** _____.
 - Watch and listen for falling rocks.
 - If you do hear rocks fall get out of their path quickly or duck and cover your head.
- **Help us** _____ **everything on the trail.**
 - Don't pick up rocks, flowers or try to touch any animals or insects on the trail.
 - Please don't feed any wildlife. It often leads to their death in the long run.

Trail Treasures

As you hike you should keep your _____ wide open. You will find a surprising variety of:

- Trees
- _____
- Wildlife
- Rocks
- **REMEMBER:** _____ *at a National Monument is protected. Please don't pick flowers, break off tree leaves or branches, collect rocks or touch the wildlife.*

The Caves

On your tour you will actually see _____ different caves.

- Hansen Cave
- _____ Cave
- Timpanogos Cave

- There are amazing things to learn in each one.

Cave Safety: Protect Yourself and the Cave

Please stay with the group and _____ carefully.

- The cave is wet in many places and you may slip.

Please don't _____ any of the cave walls or formations.

- You can easily break a delicate cave formation.
- The oils in your skin can darken the color of the formation and prevent it from growing.

Please don't _____ in the cave.

- Mold from crumbs grows quickly and is very hard to clean.
- Food may attract wildlife into the cave. Those critters can get lost and die in the cave.

Cave Treasures

There are over forty different formations in Timpanogos Cave. Here are five you should know:

- Stalactite- These hang tight to the ceiling.
- _____ - these cone shaped formations grow from the ground up.
- Column- these formations happen when stalactites and stalagmites meet.
- Drapery/_____ - these are strips of calcite that hang off of slanted walls.
- _____ - these twisted rock formations are found growing in every direction

Cave Questions

Rangers love to answer your questions and help you understand the cave better.

As you go through you might ask them:

- *Why are some formations _____ and some rough?*
- *Why are there so many _____ in different cave formations?*
- *What did it look like when the very first explorers _____ this cave?*
- *Do any animals or insects _____ inside the cave?*

Coming Down

After you are done with your tour, don't forget to be just as safe going down the trail as you were coming up.

- **Never run on the _____.**
- **Stay _____ your group.**
- **Stay _____ the trail.**
- **Be alert for falling _____.**
- **Help us protect _____ on the trail.**

A Final Word

- President Warren G. Harding made Timpanogos Cave a National Monument in 1922 because he believed it was of "**unusual scientific _____ and importance.**"
- As you enjoy the cave and the surrounding nature please remember that generations after you will _____ **you** for helping to protect and preserve this amazing place.

Timpanogos Cave (ANSWER KEY)

Everything you need to know for a perfect visit.

What to bring on your hike:

- **Water** (at least one full bottle).
- **Good shoes** (tennis shoes or hiking boots).
- **A light jacket or sweater** for the inside of the cave. Cave temperature is in the low 40's, the same as a refrigerator.
- **Sunscreen and/or a hat**

Trail Safety

- **Never run on the trail.**
 - You could trip and fall or start a rock fall.
 - You could run into someone else and cause them to get hurt.
- **Stay with your group.**
 - No one under 16 is allowed to hike alone.
- **Stay on the trail.**
 - The trail is very steep and many rattlesnakes are impossible to see until you are right on top of them.
 - Be sure to not to stop in the red stripe zones, wait to rest in safer areas.
- **Be alert.**
 - Watch and listen for falling rocks.
 - If you do hear rocks fall get out of their path quickly or duck and cover your head.
- **Help us protect everything on the trail.**
 - Don't pick up rocks, flowers or try to touch any animals or insects on the trail.
 - Please don't feed any wildlife. It often leads to their death in the long run.

Trail Treasures

As you hike you should keep your eyes wide open. You will find a surprising variety of:

- Trees
- Flowers
- Wildlife
- Rocks
- **REMEMBER:** *Everything at a National Monument is protected. Please don't pick flowers, break off tree leaves or branches, collect rocks or touch the wildlife.*

The Caves

On your tour you will actually see **three** different caves.

- Hansen Cave
- Middle Cave
- Timpanogos Cave
- There are amazing things to learn in each one.

Cave Safety: Protect Yourself and the Cave

Please stay with the group and walk carefully.

- The cave is wet in many places and you may slip.

Please don't touch any of the cave walls or formations.

- You can easily break a delicate cave formation.
- The oils in your skin can darken the color of the formation and prevent it from growing.

Please don't eat in the cave.

- Mold from crumbs grows quickly and is very hard to clean.
- Food may attract wildlife into the cave. Those critters can get lost and die in the cave.

Cave Treasures

There are over forty different formations in Timpanogos Cave. Here are five you should know:

- Stalactite- These hang tight to the ceiling.
- Stalagmite- these cone shaped formations grow from the ground up.
- Column- these formations happen when stalactites and stalagmites meet.
- Drapery/Bacon- these are strips of calcite that hang off of slanted walls.
- Helictite: these twisted rock formations are found growing in every direction

Cave Questions

Rangers love to answer your questions and help you understand the cave better. As you go through you might ask them:

- *Why are some formations smooth and some rough?*
- *Why are there so many colors in different cave formations?*
- *What did it look like when the very first explorers found this cave?*
- *Do any animals or insects live inside the cave?*

Coming Down

After you are done with your tour, don't forget to be just as safe going down the trail as you were coming up.

- **Never run on the trail.**
- **Stay with your group.**
- **Stay on the trail.**
- **Be alert for falling rocks.**
- **Help us protect everything on the trail.**

A Final Word

- President Warren G. Harding made Timpanogos Cave a National Monument in 1922 because he believed it was of "**unusual scientific interest and importance.**"
- As you enjoy the cave and the surrounding nature please remember that generations after you will **thank you** for helping to protect and preserve this amazing place.

Internet Resources for Caves



How are Caves Formed?

Article: <http://www.memphisgeology.org/images/Explorer0604.pdf>

Animation: <http://www.pbs.org/wgbh/nova/caves/form.html>

Information/Graphics: <http://www.esi.utexas.edu/outreach/caves/caves.php>

How are Mountains Formed?

Information/Graphics:

http://www.windows.ucar.edu/tour/link=/earth/interior/mountain_building.html&fr=t

<http://www.mountain.org/education/subexplore/explore02.cfm>

<http://www.woodlands-junior.kent.sch.uk/Homework/mountains/types.htm>

Erosion:

Information/Pictures: http://www.geography4kids.com/files/land_erosion.html

Information/Activity: <http://teacher.scholastic.com/dirt/erosion/whateros.htm>,
<http://teacher.scholastic.com/dirtrep/erosion/invest.htm>

Hydrology: http://www.nps.gov/archive/wica/Hydrology_PDF.htm

Scholastic®

Cave Animals lesson: <http://teacher.scholastic.com/lessonrepro/lessonplans/theme/caves05.htm>

Cave Science lesson: <http://teacher.scholastic.com/lessonrepro/lessonplans/theme/caves01.htm>

Carlsbad Caverns Cave Lessons

<http://school.discoveryeducation.com/lessonplans/>

Cave Stories

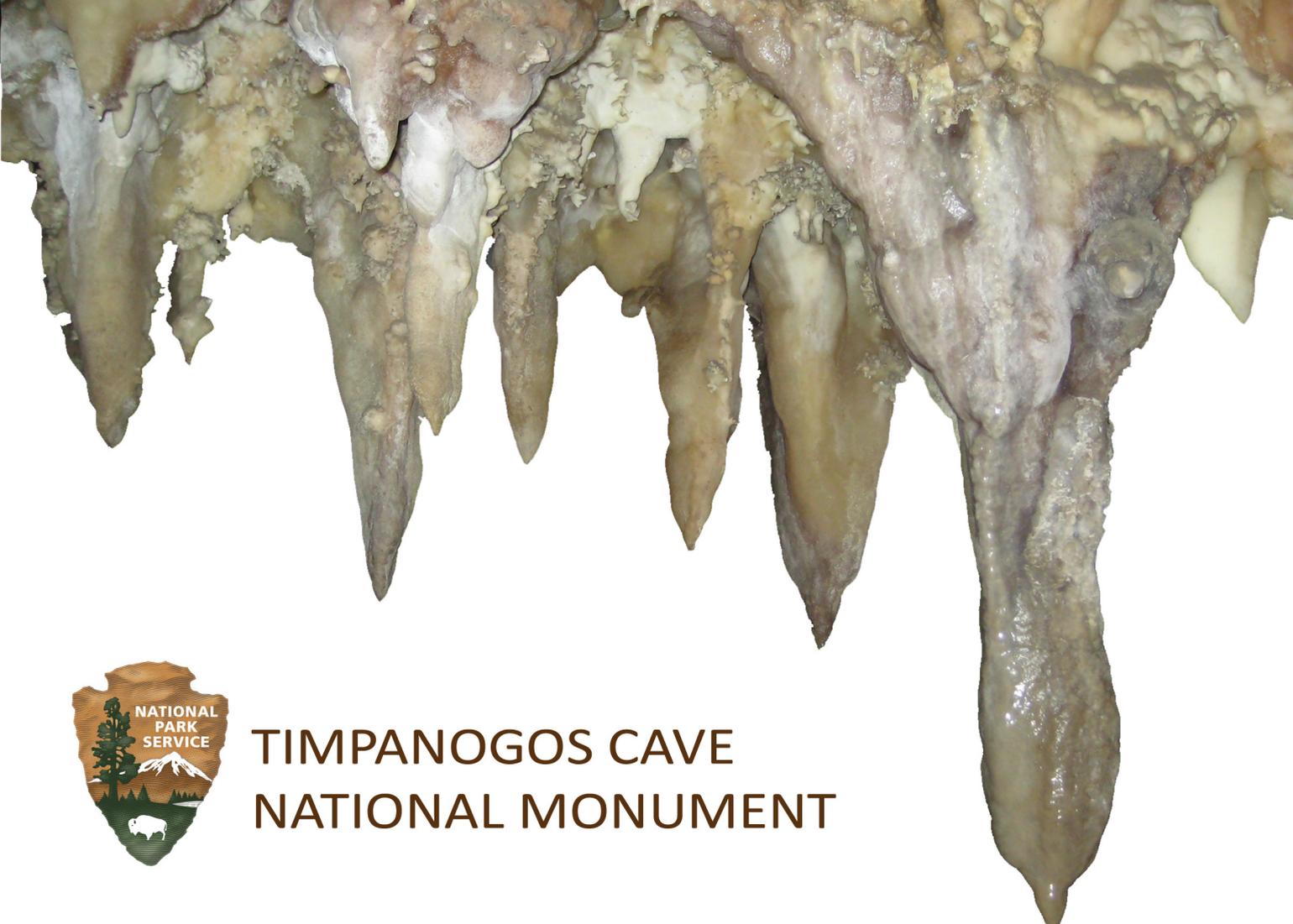
<http://www.jamesmdeem.com/stories.cave.htm>

Cave Activities

<http://www.cavern.org/acca/kidscave.php>

Web Ranger Activities

www.nps.gov/webrangers/



TIMPANOGOS CAVE
NATIONAL MONUMENT

Lessons and Activities

Post-Visit Assessments and Activities

Appendix B



Aligned to 4th and 5th Grade
Utah State Educational
Standards

Timpanogos Cave Jeopardy **ANSWERS**

Created by: Diantha Smith, June 2009

- Cave History: \$100 Martin Hansen followed this animal's tracks and found a cave.
Cave History: \$100 Answer What is a cougar?
- Cave History: \$200 The year Timpanogos Cave became a National Monument.
Cave History: \$200 Answer What is 1922?
- Cave History: \$300 You can see where Heber Hansen and Wayne Hansen came into Middle Cave if you look for this.
Cave History: \$300 Answer What is a wooden ladder?
- Cave History: \$400 Vearl Manwill and his friends "re-discovered" this cave.
Cave History: \$400 Answer What is Timpanogos Cave?
- Cave History: \$500 Eugene L. Roberts wrote a love story about this formation in the cave.
Cave History: \$500 Answer What is the heart of Timpanogos?
- Cave Formations: \$100 The formations of Timpanogos Cave often form along this crack in the rock.
Cave Formations: \$100 Answer What is a fault line?
- Cave Formations: \$200 These two formations can grow into a column.
Cave Formations: \$200 Answer What are stalactites and stalagmites?
- Cave Formations: \$300 Most of the formations in the cave are made of this mineral.
Cave Formations: \$300 Answer What is calcite?
- Cave Formations: \$400 This formation has two names. It looks like a fin coming off a sloping ceiling.
Cave Formations: \$400 Answer What is drapery or cave bacon?
- Cave Formations: \$500 This formation isn't in all caves, but Timpanogos Cave has thousands.
Cave Formations: \$500 Answer What are helictites?

- Cave Life: \$100 The name for this light colored insect.
Cave Life: \$100 Answer What is the cave cricket?
- Cave Life: \$200 These flying mammals are sometimes found near the entrances of the caves.
Cave Life: \$200 Answer What are bats?
- Cave Life: \$300 Because most life depends on this, few animals or plants can live in a cave.
Cave Life: \$300 Answer What is light?
- Cave Life: \$400 Two reasons people may get hurt or sick in caves.
Cave Life: \$400 Answer What is falling, getting lost, getting too cold (hypothermia), getting stuck, poisonous gases etc. (only 2 answers are needed)?
- Cave Life: \$500 Timpanogos Cave is not a lava tube cave, a sea cave or a boulder cave. It is this kind of cave.
Cave Life: \$500 Answer What is a solution cave?
- Cave Safety: \$100 The most important rule in the cave.
Cave Safety: \$100 Answer What is to protect the cave by not touching it?
- Cave Safety: \$200 The rule you must follow after seeing Middle Cave Lake.
Cave Safety: \$200 Answer What is to put your backpack on your front or carry it?
- Cave Safety: \$300 This happens if people eat inside the cave.
Cave Safety: \$300 Answer What are crumbs growing mold and attracting animals that could get lost and die in the cave?
- Cave Safety: \$400 This is what happens when people touch the cave.
Cave Safety: \$400 Answer What are the cave stops growing and formations turning grey?
- Cave Safety: \$500 Basic rules to follow when walking on the trail (must know at least 5).
Cave Safety: \$500 Answer What are: 1. No running, 2. Staying with an adult if you're under sixteen, 3. Staying on the trail, 4. No throwing/kicking rocks, 5. Keep moving in red stripe zones, 6. No collecting rocks/picking flowers, 7. No feeding/touching animals, etc.?
- Cave Miscellaneous: \$100 Some common forms of erosion (name at least two).

Cave Miscellaneous: \$100 Answer What are running water, glaciers, wind, waves, weathering, etc.?

- Cave Miscellaneous: \$200 The name of the most active fault in Utah.

Cave Miscellaneous: \$200 Answer What is the Wasatch Fault? (This fault doesn't run through Timpanogos Cave, but five other faults do.)

- Cave Miscellaneous: \$300 The three basic types of rocks.

Cave Miscellaneous: \$300 Answer What are igneous, sedimentary, and metamorphic?

- Cave Miscellaneous: \$400 Timpanogos Cave was carved out of this type of rock.

Cave Miscellaneous: \$400 Answer What is Deseret Limestone?

- Cave Miscellaneous: \$500 The age of the fossils in Timpanogos Cave.

Cave Miscellaneous: \$500 Answer What is about 340-350 million years old?

- FINAL JEOPARDY Who owns Timpanogos Cave?

FINAL JEOPARDY ANSWER EVERYONE! Because it is a National Monument, Timpanogos Cave belongs to all American citizens and should be cared for by every individual who comes to visit.

Who wants to be a speleologist? **ANSWERS**

1. 100: How do we know that the limestone in Mount Timpanogos was formed in ancient sea beds?
C. fossils of sea creatures
2. 200: What is the length and weight of the Great Heart stalactite?
A. 5 ½ ft. & 2 tons
3. 500: What kind of cave is Timpanogos Cave?
D. solution cave
4. 1,000: Which kind of rock are most caves found in?
A. Limestone
5. 5,000: What ceiling formation comes from dripping water
A. Stalactite
6. 25,000: What is Timpanogos Cave famous for?
D. Wide variety of colors and formations
7. 50,000: What is the average rate that Timpanogos Cave formations grow each year?
C. 1 mm or less
8. 100,000: What mineral makes calcite turn yellow and aragonite turn green?
D. Nickel
9. 250,000: What are the blind and colorless creatures in the cave called?
B. Troglobites
10. 500,000: Why did the color of the calcite flowing over this rock change?
B. the fault line shifted
11. 1,000,000: What are the names of the longest and largest caves in the world?
D. Mammoth & Sarawak



Name: _____

What Have You Learned About Caves?

Compiled by Wendy B. Smith, 2009

1. The two main ingredients in Timpanogos Cave are _____ and _____.
2. When the land shifted, cracks were made in the rocks. These cracks are called _____.
3. When water and carbon dioxide mix they make a very important cave ingredient called _____.
4. Underground holes for caves were widened by _____ and the _____.
5. The movement of _____ pushed the mountains and caves higher and higher.
6. Timpanogos Cave formations are made of the mineral _____.
7. Name three types of cave formations:

8. Other minerals carried into cave with calcite change formation _____.
9. In a year cave formations grow about _____ in length.
10. Name three types of caves:

11. The world's longest cave is in the state of _____.
12. Name two cave dangers: _____ and _____.



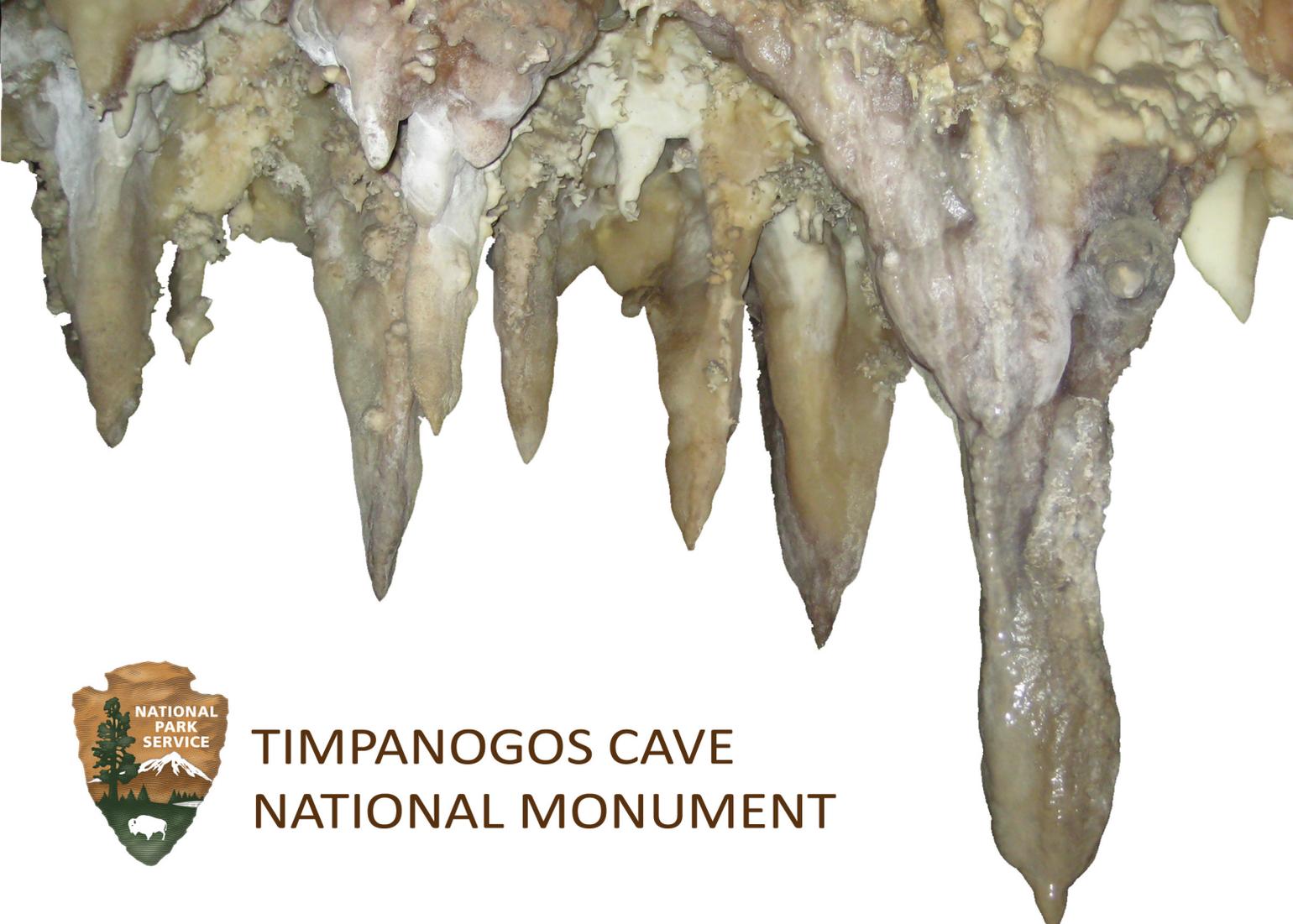
Timpanogos Cave Fieldtrip Writing Activity

Name: _____ Date of fieldtrip: _____



Classroom Cave Newspaper – Reporters (students) choose a story/activity to submit

- ❖ Stories/reports – i.e.
 - Cave Power outage
 - Cave Earthquake/flood disaster
 - “white nose disease” in bats
 - Cave mining
- ❖ Cave cartoon
- ❖ Cave sports
- ❖ Cave Business news
- ❖ Cave weather
- ❖ Cave obituaries
- ❖ Cave Celebrations (announcements for weddings, anniversaries, etc.)
- ❖ Cave Advertisements: i.e. groceries, real estate, furnishings
- ❖ Cave entertainment
- ❖ Movie/TV listings (Batman,
- ❖ Cave recipes
- ❖ Cave editorial
- ❖ Classifieds
- ❖ Activities
 - Cave Crossword puzzle
 - Cave Word search
 - Cave word scramble



TIMPANOGOS CAVE
NATIONAL MONUMENT

Evaluation

Fieldtrip and Lesson Resources



Aligned to 4th and 5th Grade
Utah State Educational
Standards

Timpanogos Cave Field Trip Packet Evaluation



School: _____ Date of field trip: _____

Compiled by Wendy B. Smith, 2009

1. Which of any of the following pre-visit activities did you use to prepare your students to come to the cave?

- "What Do You Know About Caves" worksheet "Cave Basics" PowerPoint
 "Timpanogos Cave-Before You Come" PowerPoint Recipe Organizer
 Making Stalactites and Stalagmites Reader's Theater
 Pre-assessment KWL Chart Internet resources sheet

2. Which of the above activities was most helpful for your classroom?

| Activity: | How helpful in classroom: |
|-----------|---------------------------|
| | |

3. Do you feel the teaching packet connected to your grade level core standards? ___ Yes ___ No

4. What additional resources would be helpful for your classroom?

| Resources: | How helpful in classroom: |
|------------|---------------------------|
| | |

5. Do you plan to use any of our post-visit assessment& activities in your classroom?

- "Who Wants to Be a Speleologist?" PowerPoint "Cave Investigation" PowerPoint
 "Cave Jeopardy" PowerPoint Cave Creatures Writing Activity
 Follow-up KWL chart

6. What suggestions do you have to improve our packet/activities?

| Activity: | How to improve: |
|-----------|-----------------|
| | |

7. Now that you are more aware of these resources, do you anticipate using any of them in the future?

___ Yes ___ No

Thank you for giving us feedback. We hope to make these teaching materials the best they can be.

Please return this evaluation to us at Timpanogos Cave NM, RR 3 Box 200, American Fork, UT 84003

Or email this or any other responses to Karissa DeCarlo at karissa_decarlo@nps.gov