

# Making a Cave: Earth's Surfaces



## How did the Timpanogos Cave system form?

One thing we know for sure is that the surfaces of the earth are always changing. With uplift, erosion, weathering, deposition and fault lines the surface of the earth is slowly on the move.

It's forces such as these that have helped create the cave with the help of five very important ingredients. Based on current evidence we believe the Timpanogos Cave system is somewhere between 1 and 3 million years old and we know it's still growing and changing today.

### Vocabulary:

**Geology:** the study of the earth.

**Carbon Dioxide:** A colorless, odorless gas that is absorbed by plants to make oxygen.

**Dissolution:** The process of dissolving rocks over time.

### Cool Cave Facts

**Cave Length:** 6,275 feet

**Cave depth:** 175 feet

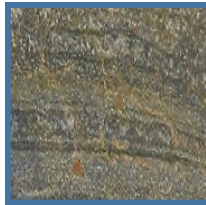
**Average Temperature:** 45°

## Rock Cycle Review:



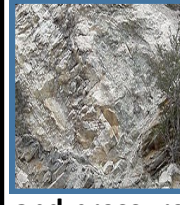
**Igneous rocks** are formed when rock is Super-heated and becomes **molten**

(liquid). There are two kinds of molten rock: magma (found beneath the Earth's surface) and lava (found on the Earth's surface). The **molten rock cools and hardens** on or beneath the Earth's surface forming a variety of igneous rocks. Two examples are granite and basalt.



**Sedimentary rocks** are made of smaller pieces (like **sand or mud**), called sediments,

that pile into layers. As pressure on the sediment increases over time, minerals act like glue, cementing them into solid rock. Some examples of sedimentary rocks are: sandstone, shale, and limestone.



**Metamorphic Rock** are rocks that have been **changed under great heat**

**and pressure.** The original rock can be sedimentary, igneous, or even metamorphic. The original rock is changed into something new, just as a caterpillar "metamorphoses" into a butterfly. Some examples of metamorphic rock are quartzite and slate.



## Rock: Limestone

The rock near the cave is called Deseret Limestone which formed during the Mississippian era around 330 million years ago. Limestone is a sedimentary rock, meaning it was built layer by layer. It is also considered a soluble rock meaning it's easy for this type of rock to be dissolved, over time forming holes through **dissolution**.

During the time that these rocks were forming, most of the state of Utah was covered by a warm shallow sea and was nearer to the equator. Because of this sea there are many sea fossils found in the rock both near and inside the cave including coral and brachiopods.



## Fault Lines:

The earth is made up of three main layers: the crust, the mantle, and the core. The core is made up of several different tectonic plates that move and push up against each other. Within these plates there are additional cracks called fault lines.

A fault line is a break in the earth's surface. The Timpanogos Cave System is home to five small fault lines. People often think of earthquakes when they talk about fault lines. The area the cave is located in has been expecting a huge earthquake for over fifty years. An

earthquake is the result of two plates or two sides of a fault line slipping past each other. When two plates push up against each other they can make mountains and valleys. This is called uplift.

The fault lines in the cave have the biggest groupings of formations because it's where water and minerals can get into the cave.





## Water:

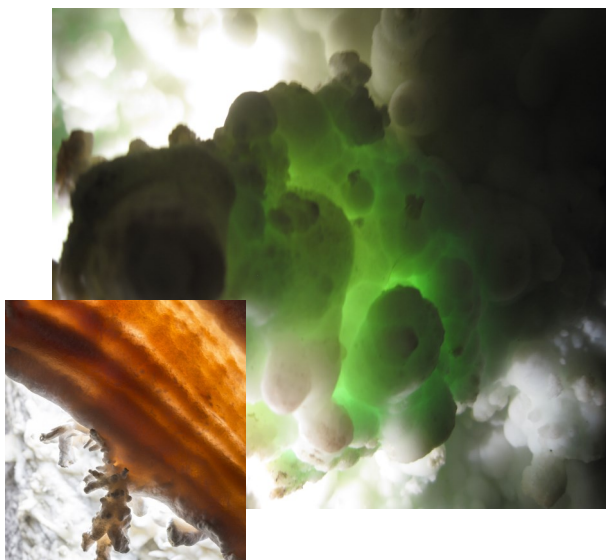
Once rainwater hits the ground it can go several different places. It can evaporate, flow into lakes and rivers, or seep into the ground, often through fault lines. Once water seeps deep enough into the earth it runs into carbon dioxide. Water ( $\text{H}_2\text{O}$ ) and Carbon Dioxide ( $\text{CO}_2$ ) create Carbonic Acid ( $\text{H}_2\text{CO}_3$ ). This is a very weak acid, about as strong as the acid in soda pop, but strong enough to slowly dissolve rock. This helps create open passages inside the cave.

Water is also responsible for helping create the formations inside the cave. Water picks up different minerals in the rock and carries them into the cave. Then it deposits the mineral on the rock before dripping or flowing down. A cave that has water dripping or flowing—no matter how slowly—is considered an active cave. Active caves have formations that are still growing. All three caves in the Timpanogos Cave System are considered active caves.

## Minerals:

Everything that cannot be grown is a mineral or made up of minerals. Minerals are the building blocks that make up rocks. The Timpanogos Cave system has countless formations made out of many different minerals. Each mineral brings a different color into the formations. The main mineral is Calcite ( $\text{CaCO}_3$ ). Calcite is found in large amounts in sedimentary rocks, limestone in particular. Calcite gives the cave the bright white color that is found throughout most of the cave.

Calcite is just a little bit harder than your fingernails and like your fingernails cave formations can break if people aren't careful. The minerals in the cave are both beautiful and fragile. Other minerals make other colors. Iron Oxide creates a reddish color. Manganese makes a purplish color. Green comes from nickel mixed with aragonite while yellow is nickel mixed with calcite.





## Time

This kind of timeline is a little hard to understand. The earth is approximately 4.6 billion years old. About 3.8 billion years ago single cell living things started arising on the surface of the earth. Pangea broke apart 200 million years ago. Dinosaurs were alive between 250-65 million years ago, they roamed the earth for 165 million years! That's about 8 times longer than humans have been on earth.

We think the Timpanogos Cave System is somewhere between 1-3 million years old. This seems really old to you and me, but in geologic time the cave is still a baby. There is a quickly growing formation inside Timpanogos Cave which was measured over the course of 60 years and in that time it grew about the length of a tic-tac, meaning it could take almost 200 years to grow a single inch. Because caves are so slow growing it's important to protect them. Any damage done to the caves could take thousands or millions of years to repair; if ever.



**The Timpanogos Cave System has been a National Monument since 1922, that's almost 100 years! Back then they were preserving the land for their children and their children's children. That's us. They were thinking of us when they decided to protect the cave system and it's up to us to keep protecting the cave and all of our other National Parks for future generations. The cave system gives us the opportunity to learn about and see up close the forces that change the surface of the Earth. It also gives us the chance to be inspired by the beauty of the cave What would you do if you found an undiscovered cave?**



### **Group 1-Limestone Questions:**

1. What kind of rock is limestone?
2. How long ago did this limestone rock form?
3. How are sedimentary rocks formed?
4. Limestone is a soluble rock, what does that mean?
5. During the time this rock was forming most of the state of Utah was covered by a \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_. Because of this what types of fossils are found near and inside the cave?

### **Group 2-Fault Lines Questions:**

1. What are the three main layers of the Earth?
2. A fault line is a \_\_\_\_\_ in the \_\_\_\_\_.
3. How many fault lines does the Timpanogos Cave system have?
4. What causes an earth quake?
5. What is uplift?

### **Group 3-Water Questions:**

1. Name three places that rain water can go after it hits the ground.
2. When water seeps deep into the ground it runs into \_\_\_\_\_ and creates \_\_\_\_\_. This is a very \_\_\_\_\_ acid about as strong as the acid in \_\_\_\_\_.
3. Besides dissolving out rock to make cave passages water also helps create what?
4. When water picks up minerals, carries them into the cave, and deposits the mineral onto the rock what does that process create?
5. What is an active cave?

### **Group 4-Minerals Questions:**

1. Everything that cannot be \_\_\_\_\_ is a \_\_\_\_\_ or made up of \_\_\_\_\_.
2. What is the main mineral found in the Timpanogos Cave system?
3. Where is that type of mineral found in large amounts?
4. What is calcite just a little bit harder than?
5. There are many different minerals in the cave, what do the different minerals make?

### **Group 5-TimeQuestions:**

1. How old is the earth?
2. How long ago did dinosaurs live and how long did dinosaurs roam the earth for?
3. How old do we think the Timpanogos Cave system is?
4. Is the cave considered to be an old cave or a young cave?
5. How long would it take for the fast growing formation that has been measured to grow a single inch?