

Carlsbad Caverns



Geology - The Creation of the Cavern

The story of the creation of Carlsbad Cavern begins 250 million years ago with the creation of a 400 mile long reef in an inland sea that covered this region. This horseshoe shaped reef formed from the remains of sponges, algae and seashells and from calcite that precipitated directly from the water. Cracks developed in the reef as it grew seaward. Eventually the sea evaporated and the reef was buried under deposits of salts and gypsum.

Then, a few million years ago, uplift and erosion of the area began to uncover the buried rock reef. Rainwater, made slightly acidic from the air and soil, seeped down into the cracks in the reef, slowly dissolving the limestone and beginning the process that would form large underground chambers. At the same time, hydrogen sulfide gas was migrating upward from vast oil and gas deposits beneath the ancient reef. This gas dissolved in the percolating ground water to form sulfuric acid. The added power of this corrosive substance explains the size of the passageways. The exposed reef became part of the Guadalupe Mountains and the underground chambers became the wonder of Carlsbad Cavern.

The Cave is Decorated, Drop by Drop

The decoration of Carlsbad Cavern with stalactites, stalagmites and an incredible variety of other formations began more than 500,000 years ago after much of the cavern had been carved out. It happened slowly, drop by drop, at a time when a wetter, cooler climate prevailed. The creation of each formation depended on water that dripped or seeped down into the limestone bedrock and into the cave. As a raindrop fell to the ground and percolated downward, it absorbed carbon dioxide gas from the air and soil, and a weak acid was formed. As it continued to move downward the drop dissolved a little limestone, absorbing a bit of the basic ingredient needed to build most cave formations--the mineral calcite.

Once the drop finally emerged in the cave, the carbon dioxide escaped into the cave air. No longer able to hold the dissolved calcite, the drop deposited its tiny mineral load as a crystal of calcite. Billions and billions of drops later, thousands of cave formations had taken shape. And, oh, the shapes they took! Where water dripped slowly from the ceiling, soda straws and larger stalactites appeared. Water falling on the floor created stalagmites. Sometimes a stalactite and stalagmite joined, forming a column.

Draperies were hung where water ran down a slanted ceiling. Water flowing over the surface of a wall or floor deposited layers of calcite called flowstone. Cave pearls, lily pads and rimstone dams appeared where pools of water or streams occurred in the cave. Like oyster pearls, cave pearls were made as layer upon layer of calcite built up around a grain of sand or other tiny object. Lily pads formed on the surface of pools, while dams formed where water flowed slowly on the floor. Another type of cave formation that decorated cave walls and even other formations was popcorn, which may have formed when water evaporated and left behind calcite deposits.

Some of the more unusual formations to occur in Carlsbad Cavern are helictites, which grow seemingly without regard to gravity, their twisting shapes governed by crystal shapes, impurities and the force of water under pressure. Other rare formations are those composed not of calcite, but of aragonite, a mineral chemically identical to calcite but with a different crystal structure. These formations tend to be small, delicate and needle-like.

Location

Carlsbad Caverns National Park is located in New Mexico's Chihuahuan Desert, and its landscape is dominated by the Guadalupe Mountains. As its name suggests, the park is especially known for its impressive cave complex. There are over 300 caves in the Guadalupe Mountains. However, it is more than just the outstanding beauty of the caverns that make this park unique geologically. Large limestone deposits containing exceptionally well-preserved marine fossils representing a Permian reef complex are exposed in the mountains. Additionally, the way the park's caves formed sets them apart from other karst systems.

Internal Forces/External Forces

Caves are environments that contain not only fantastic mineral formations but rare and unusual animals. These include blind fish, colorless spiders, and many other troglobites (pronounced TROG-lah-bites), animals that live in caves and cannot survive outside of them. Troglobites have evolved over millions of years, becoming adapted to the absolute blackness and meager food offerings of cave life. Caves are also home to animals that venture out periodically in search of food. Beetles, crickets, frogs, salamanders, and others are of this type. Finally, caves serve as temporary homes to animals that move freely in and out of them. Bats, bears, moths, and skunks are examples of these.

For many people, cave exploration is a fascinating and fun activity. Spelunking (pronounced spi-LUNG-king) is the term given to such exploration. Spelunking societies, organizations, and groups exist across the country, helping people explore the more than 100 caves that are open to the public for study and enjoyment.

Although caves are carved out of rock, they are fragile. Vandalism, property development, and air and water pollution have all had a devastating effect on caves and cave life. Even oil left on a speleothem by the accidental touch of a human hand can alter its formation, eventually destroying it. Of the more than 130 species that inhabit the Mammoth Cave System in Kentucky, dozens are considered threatened or endangered. For the continued study and exploration of caves and the life they harbor, great care must be taken.

Most caves are constantly changing. Some are still enlarging, with new passages being formed below the water table (in a cave system, the oldest caves and passages are closest to Earth's surface). Many caves are still wet, with calcite being deposited on various formations. Other caves and cave systems, however, are dry and are no longer enlarging or growing speleothems. Eventually, in a dry cave, the thin ceiling may lose support and collapse, exposing the cave to the surface through a sinkhole.

Some Examples

Lechuguilla Cave, New Mexico

The deepest limestone cave in the United States is Lechuguilla (pronounced lech-uh-GEE-yah) Cave. Part of the Carlsbad Caverns cave system in southeast New Mexico, it extends to a depth of 1,571 feet (479 meters). The cave was discovered by a group of cavers in 1986. Scientists estimate that the cave has existed beneath Earth's surface for at least 2 million years.

The cave is notable not only for its size, but for its fantastic array of rare speleothems. Unlike other solution caves, Lechuguilla was not formed by carbonic acid. Rather, rising hydrogen sulfide from nearby oil fields reacted with groundwater to form sulfuric acid. This acid dissolved the limestone and created a cave filled with lemon-yellow sulfur formations. Among those is a 24-foot (7.3-meter) soda straw, the longest in the world.

In addition to unusual speleothems, Lechuguilla contains rare bacteria that feed on the sulfur, iron, and manganese minerals present in the cave. Scientists believe these bacteria may have played a part in the formation of the cave and its speleothems. They also believe the sulfur-laden environment of Lechuguilla may be similar to that on the surface of Mars, so they have studied the cave's bacteria to determine how life may exist on that planet.

Mammoth Cave System, Kentucky

The Mammoth Cave System, properly known as the Mammoth Cave-Flint Ridge System, is the largest cave system in the world. Lying beneath the surface in south-central Kentucky, the system extends for more than 345 miles (555 kilometers) and to a depth of 379 feet (116 meters). Geologists believe there may be an additional 600 miles (965 kilometers) of undiscovered passageways connected to the system.

Scientists estimate the system began to form in the limestone rocks underlying the area some 30 million years ago. Archaeologists have found evidence that early Native Americans inhabited the cave system as many as 4,000 years ago.

The land surface above Mammoth Cave System is marked by sinkholes and losing streams. Underneath this karst topography lie tunnels, passages, caverns, and almost every type of speleothem. Underground rivers flow through some of the system's deepest caverns. Mammoth Dome is a cavity in the system that measures 192 feet (59 meters) in height. Another extraordinary feature is Frozen Niagara, a mass of flowstone 75 feet (23 meters) tall and 4 feet (1.2 meters) wide.

Voronya Cave, Republic of Georgia

On January 6, 2001, a team of Ukrainian and Russian cavers exploring a cave in the Abkhazia region of the Republic of Georgia reached a depth of 5,610 feet (1,710 meters). This event confirmed Voronya Cave (also known as Krubera Cave) as the world's deepest cave. The previous record holder had been Lamprechtsofen-Vogelshacht Cave in Austria, which measures 5,355 feet (1,632 meters) in depth.

Voronya Cave was so-named because of the large number of crows that gather around its entrance (*voron* is Russian for "crow"). Discovered in the late 1960s, the cave is located in a valley in the western Caucasus Mountains. Meandering downward through dense limestone, the cave features one entrance that leads to three branches. When first explored in the 1980s, the cave was thought to end in a narrow passage 1,110 feet (3,335 meters) beneath the surface. In 1999, an expedition found new passages that led to deeper pits.

Sources

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