Missouri School for the Blind

Capstone Project 2017 Structural Geology

Blanchard Springs Caverns

How Caverns and the Speleothems within them are formed.

Blanchard Springs Caverns.

Topography is the shape of Earth's surface and its physical features, such as mountains, valleys, canyons, and other landforms. A particular type of topography is significant to the study of Blanchard Springs Caverns. It is called karst. The term karst describes a distinctive topography that indicates dissolution (also called chemical solution) of underlying soluble rocks by surface water or ground water. In karst, the landscape is dotted with sinkholes which can vary widely in number and size. Sinkholes (also known as dolines) are surface depressions formed by either: 1) the dissolution of bedrock forming a bowl-shaped depression, or 2) the collapse of shallow caves that were formed by dissolution of the bedrock. These sinkholes or shallow basins may fill with water forming lakes or ponds. Springs are locations where ground water emerges at the surface of the earth. (USGS, Tau, Gallaway, Tinsley III)

Disappearing streams are streams which terminate abruptly by flowing or seeping into the ground. Disappearing streams are evidence of disrupted surface drainage and thus indicate the presence of an underground drainage system. Cave entrances are natural openings in the earth large enough to allow a person to enter. Caves may reflect a complex underground drainage system. (USGS – Alpha, Galloway and Tinsley III)

As stated in the introduction, the term karst describes a distinctive topography that indicates dissolution of underlying rocks by surface water or ground water. Water falls as rain or snow and soaks into the soil. The water becomes weakly acidic because it reacts chemically with carbon dioxide that occurs naturally in the atmosphere and the soil. This acid is named carbonic acid and is the same compound that makes carbonated beverages taste tangy. Rainwater seeps downward through the soil and through fractures in the rock responding to the force of gravity. The carbonic acid in the moving ground water dissolves the bedrock along the surfaces of joints,

fractures and bedding planes, eventually forming cave passages and caverns. Limestone is a sedimentary rock consisting of calcium carbonate in the form of the mineral calcite. Rainwater dissolves the limestone by the following reaction:

Calcite + Carbonic acid = Calcium ions dissolved in ground water + Bicarbonate ions dissolved in ground water. (USGS, Bliss, Hays, Orris)

Cracks and joints in the bedrock allow the water to reach a zone below the surface of the land where all the fractures and void spaces are. If the ground water that flows through the underlying bedrock is acidic and the bedrock is soluble, a distinctive type of topography, karst topography, can be created. (USGS – Alpha, Galloway and Tinsley III)

Blanchard Springs Cavern in Northern Arkansas has been known for more than 100 years. The area receives on average 4.1 feet of rainfall and has 290 feet of soluble limestone where the cave is formed. That makes it the second largest by volume cave in the state of Arkansas. It has 8.1 miles of surveyed cave. The age of the cave is unknown. Some of the speleothems are 2 to 5 million years old. (D. Goodwin, Caves and Karst of the USA, A. Palmer and M. Palmer, Copyright 2009, National Speleological Society, Inc.)

Cave Formations or Speleothems.

Rainwater in the soil zone reacts with soil CO2 to create weakly acidic water via the reaction: $H_2O + CO_2 \rightarrow H_2CO_3$. This acid dissolves limestone and the water then becomes saturated with calcite which over time, the accumulation of these precipitates forms stalagmites, stalactites, and flowstones, which compose the major categories of speleothems. Stalagmites form on the floor and grow up, stalactites form on the ceiling and grow down, flowstones form on the walls as water flows down the wall.

Blanchard Springs has formations that are formed by this carbonate dissolution reaction of acidic rainwater dissolving the limestone making the cave larger and at the same time precipitating $CaCO_3$ in the form of calcite. One of these formations is spectacular for its size. It is a giant calcite flowstone at 164 feet long, 33 feet wide, and 30 feet thick. It was made from the movement of calcite rich water moving through the cave and being deposited as it slowly moved or dripped from the ceiling. This process likely took millions of years to occur. One other formation in the cave is called the cave shield which is a flat-topped speleothem with a tapering body. It too was formed by precipitation of calcite but scientists aren't sure exactly how this occurs, so the mystery continues.

Works Cited

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