Counting Cave Shields: A Lehman Caves Study

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Introduction

Cave shields are relatively rare speleothems found in a limited number of caves around the world. Little research has been done on them.

One cave particularly noted for cave shields is Lehman Caves, located in White Pine County, NV, The cave has been open to the public as a show cave since 1885. It became a national monument in 1922 and was incorporated into Great Basin National Park in 1986. Thousands of visitors each year make the trip to Lehman Caves to experience its rich history and many beautiful features.

Park lore estimated around 300 cave shields exist within the cave, but an extensive investigation of the shields had not been conducted.

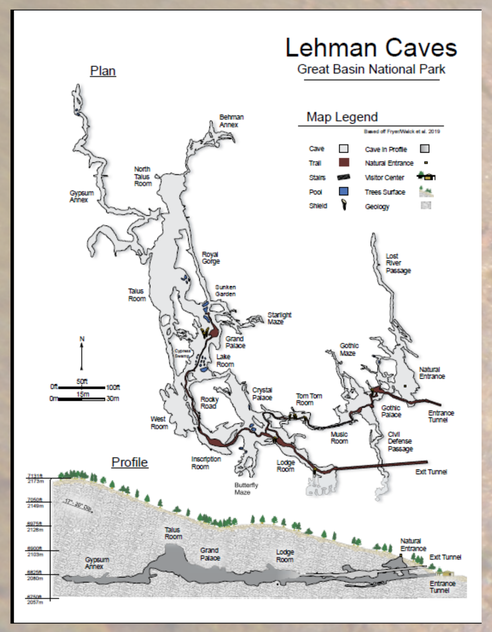

Figure 1. Lehman Caves is a 3 km (2 mile) long cave in Great Basin National Park, located in east-central Nevada. The cave sits in Middle Cambrian Pole Canyon limestone, which has been locally metamorphosed.

Figure 4. Cave shields covered in secondary deposits located in the Grand Palace room.

What is a Cave Shield?

Cave shield formation is still puzzling. It is hypothesized that cave shields form along joints or cracks in the ceiling, wall, and floor of the cave through the process of capillary action. Calcite-rich water under hydrostatic pressure moves through the joints and cracks within the bedrock. As this water loses carbon dioxide to the cave chamber, it precipitates calcite on either side of the crack, creating an extension of the crack. This builds disks of concentrically layered calcite separated by a thin, capillary sized crack. The thin, planar crack is referred to as a medial crack (Figure 2). The result is two thin calcite disks separated by a thin, water-filled void (Hill and Forti, 1997; Palmer, 2007).

New shield growth occurs along the outer rim where CO_2 degasses, and the seep water becomes supersaturated with calcite (Hose, 2018a). Periods of increased water flow can inundate the capillary seepage causing gravitational water to deposit secondary growths at the bottom and rim of the shield in the form of dripstone (Palmer, 2007; Hose, 2018).

Figure 2. On the left, the medial crack in this cave shield is easily seen, separating the two plates of the cave shield. On the right, one of the 34 cave shields that appeared to originate from the floor.

Methods

A Geoscientist-in-the-Park was hired to lead a cave inventory project in early 2020. Within that inventory, she designed and implemented the cave shield study. Each shield-like feature was assigned a number, marked on a map, and measured (width, azimuth, inclination). Any nearby joints or fractures were also measured. Medial cracks were noted, as well as location of the cave shield within the passage (floor, ceiling, and wall; Figure 2).

Results

In total, 504 visible cave shield features were identified and measured.

A few findings:

- 156 shield features display a visible medial crack
- 167 shield features are located on the ceiling
- 34 shield features are located on the floor
- 303 shield features are on cave walls or other speleothems (Figure 3)
- The largest shield was 3 m (10 ft) across
- The average shield width was 0.5 m (1.8 ft) across
- Average azimuthal direction was 168.8 degrees
- Average inclination was -9.0 degrees
- About 100 cave shields showed evidence of condensation corrosion

Most shields were covered in secondary deposits on both the top and bottom of the feature (Figure 4). These deposits included columns, helictites, coralloids, drapery, stalactites, and soda straws. Only 61 shield features were identified as having a smooth appearance, either on the top or the bottom.

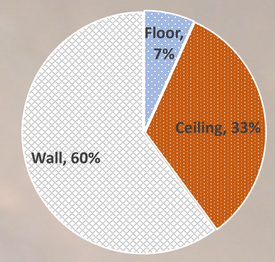

Figure 3. Cave shield location was predominantly on cave walls, followed by ceilings and floors.

Discussion

This integrated study within Lehman Caves provided a better understanding of the quantity and distribution of the shields and postulate how they grow and develop, filling a critical information gap for the Park. More work is needed to understand their origin and why so many are found in this particular cave.

References

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