

# The Shoshone Canyon Conduit Cave: A Greater Yellowstone Ecosystem Sulfur Cave

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## Abstract

Five miles west of Cody, Wyoming and ~25 miles east of Yellowstone National Park lies the Shoshone Canyon Conduit Cave (Fig. 1, Suppl. material 1). Bisecting Cedar Mountain, an irrigation tunnel built by the Bureau of Reclamation (BoR), managed by the Heart Mountain Irrigation District, delivers water from the BoR Buffalo Bill Reservoir to more than 30,000 acres of irrigated lands in and around Cody. During the construction of that tunnel in the late 1940's, a cave was discovered and the tunnel was made to travel through the cave with only light disturbance to the cave. The cave can only be accessed with permission in the non-irrigation time of year. The cave is rich in sulfides and sulfur deposits with unique speleothems.

To date, we have conducted a preliminary geobiological survey of the geochemistry, microbiology and mineralogy of this sulfur cave on its speleothems, mineral deposits and waters. Sampled waters, of which there is little, were all highly acidic ( $\text{pH} < 2$ ). Microbiologically, an analysis of microbial communities present in approximately 25 sample locations (Fig. 1) to answer the question of—who is there?—was conducted via small subunit ribosomal 16S rRNA gene (for Bacteria and Archaea) and 18S rRNA (for Eukarya) analyses, prepared using a polymerase chain reaction (PCR) primer-pair that allows for the even amplification of all three domains of life. All samples were relatively low in biomass and resultant community analysis indicates a variety of Bacteria and Archaea phyla are represented with a dominance of known sulfur metabolizers. Mineralogically, petrography reveals a variety of crystal growth and habit in this sulfur-dominated, calcium carbonate-driven karstic ecosystem. X-ray diffraction analysis (XRD) was used to better determine the kinds and extent of mineral morphotypes and were surprisingly variable. The Shoshone Canyon Conduit Cave is a most intriguing sulfur cave to reveal what is known of the geobiology of sulfur caves in the Rocky Mountain Region. Findings from this work will likely apply to other cave systems such as Villa Luz (Mexico) and the Frasassi system (Italy). Finally, to learn about the Cedar Mountain Caves will inform on how either or both the National Park Service (NPS) and Bureau of Land Management (BLM) may better manage them as a meaningful component of the Greater Yellowstone Ecosystem.

## **Keywords**

Sulfur Cave; Shoshone Canyon Conduit Cave; Greater Yellowstone Ecosystem

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## **Ethics and security**

There are no ethical or security concerns.

## **Author contributions**

John R. Spear conceptualized the work, wrote a grant to the National Cave and Karst Research Institute, supervised the work, conducted field work and investigated the work.

All other authors investigated the work.

## **Conflicts of interest**

The authors have declared that no competing interests exist.



Figure 1.

*Left:* unknown sulfidic mineral; *Middle:* “Elephant’s Feet” stalactites, formation mechanism, unknown; *Right:* Pure sulfur crystal soda-straw stalactites emerging out of stinky cave wall crust. (All colors, natural).

## Supplementary material

### **Suppl. material 1: The Shoshone Canyon Conduit Cave: A Greater Yellowstone Ecosystem Sulfur Cave**

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