Shoshone Canyon Conduit Cave

- Shoshone Canyon Conduit Cave (SCCC) lies five miles west of Cody, Wyoming.
- Cave found during the building of an irrigation tunnel through Cedar Mountain, is within the conduit tunnel.
- Contains a high number of sulfides and sulfur deposits, alongside many unique speleothems.
- Research has been conducted on other caves in the area but little on this specific cave.
- 16S rRNA gene analysis showed low diversity between samples on the cave.
- Due to the low biomass of the cave system, there is an incomplete sulfur cycle.
- XRD or XRF to determine the mineral composition of different formations.
- Greater diversity between samples on the cave.
- Research has been conducted on other caves in the area but little on this specific cave.
- Another item to work on is getting geochemical data from the cave to better understand the system.
- Most of the microbes present are sulfur metabolizing bacteria, notably Acidithiobacillus and Anaerolineaceae.
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- Sulfur sodom straws and helictites were present in many parts of the cave, as of yet it is uncertain how they formed.
- This structures we named "Elephant’s Feet" due to their shape, with their bases appearing at differing heights. Cutting one open revealed a mineral cluster in the middle of the base. It is uncertain how they formed.
- There is a possible sulfur cycle present in this cave, and is probably a lot more complex when the metabolic reactions from the various chemoautotrophs are added, helping to push more reactions to produce the different parts of the cycle.
- Ferroplasma is interesting as it oxidizes sulfur and helps the cycle progress, but doesn’t actually touch sulfur or sulfuric acid in it’s metabolic processes.
- Acidithiobacillus can both electron accept and donate in the S cycle, but as the species is uncertain, an approximation can only be made for it’s role in the cycle.
- As Anaerolineaceae is a family, more research has to be completed to determine its role in the cycle.

Possible Sulfur Cycle in SCCC

Microbial Diversity and Speleothem Type

- The closer a sample is to a speleothem, the greater difference it has to the rest of the microbial population.
- This indicates that the different speleothems host different factors that contribute to the growth of different microbes.
- Interestingly, the wall sediment samples are all quite similar, even as only one is from a crystal formation.
- Greater diversity between samples on the cave floor could come from the different microbial communities in speleothems dripping onto the cave floor, and past explorers mixing the population by trekking soil around the cave.
- Due to the low biomass of the cave system, there were multiple samples taken of crystals and formations that did not have enough biological information to complete bioinformatic analysis.

Future Work

- While interesting it looks like there was a sulfur cycle within the cave, this is just scratching the surface for understanding this cave and it’s development.
- There are a lot of interesting formations that we don’t have an understanding of how they developed so further analysis is needed.
- For mineral formations:
  - Petrography to determine what growth is regular crystal growth and what growth has biological influence
  - XRD or XRF to determine the mineral composition of different formations
- For the microbiome:
  - Further sampling within the cave system, ideally getting a transect of the cave to see how the diversity of taxa change along that transect
  - Gathering more information at each sampling site to determine what is causing the changes in microbe presence at each location
- Other items to work on is getting geochemical data from the cave to better understand the system.

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Citations


Figures

- Figure 1: Paul Slayback and Rebecca Schrorni inside SCCC beneath a characteristic formation called "Elephant’s Feet".
- Figure 2: Sulfur sodom straw hanging off stalactite.
- Figure 3: Diagram showing the possible steps in the possible sulfur cycle within SCCC, showing where microbial influences come into play. This is a simplified diagram, mostly showing only how sulfur moves through the cycle. There is oxygen and water that also plays into this cycle, but it is excluded from the diagram for clarity.
- Figure 4: Heatmap showing the taxa present in SCCC based on the cave survey tag they were taken nearby. The more orange, the more of that species was present at that location, and the bluer a box indicates that there is less of that species present.
- Figure 6: A beta diversity plot using an NMDS ordination to show the difference in each sample location as compared to the type of feature the sample was taken from and the proximity to a type of speleothem.
- Figure 7: Images of more formations inside of Shoshone Canyon Conduit Cave. Top left: An image taken of the fluorescence of the formation in the bottom left. Right: A sulfur helictite inside of SCCC.

What’s in SCCC?

SCCC is a cave with a lot of unique speleothems and a unique microbe diversity due to its low diversity.