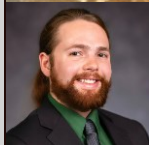


# Seeking to Understand the Microbiome of Caves Using New Tools and Techniques

Caleb Crubaugh  
Texas A&M University  
[John.c.crubaugh@gmail.com](mailto:John.c.crubaugh@gmail.com)



# Introduction



**Caleb Crubaugh**  
Senior Undergraduate Student  
Texas A&M University



## Mentor



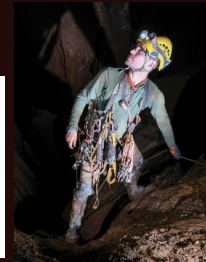
**Dr. Hazel Barton**  
Assistant Professor  
University of Alabama



## Field Supervisor



**Max Koether**  
PhD Student  
University of Alabama

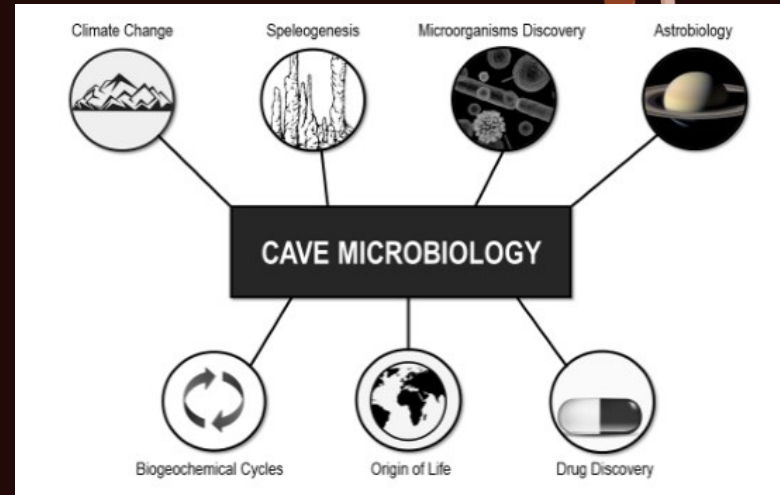


# Cave Microbiology

## An Introduction

Microbial communities within caves can form acid byproducts through their metabolic pathways. Those acids then dissolve limestone, creating large cave passages over time. These microbes also develop unique traits to adapt to their extreme, isolated environments.

Dr. Barton's lab researches the unique processes these extremophile cave microbes possess.



Ghezzi, D. <1989>. (2020, April 2). *Microbial diversity and metabolic potential in caves* (Doctoral Thesis). Alma Mater Studiorum - Università di Bologna. <https://doi.org/10.48676/unibo/amsdottorato/9467>

# Testing Samples Taken from Caves in Borneo to Understand the Microbial Processes Contributing to Their Large Size

**Max Koether**

-Cave explorer and graduate student in Dr. Barton's lab at the University of Alabama.



Photos by Dr. Hazel Barton

Cave in Borneo

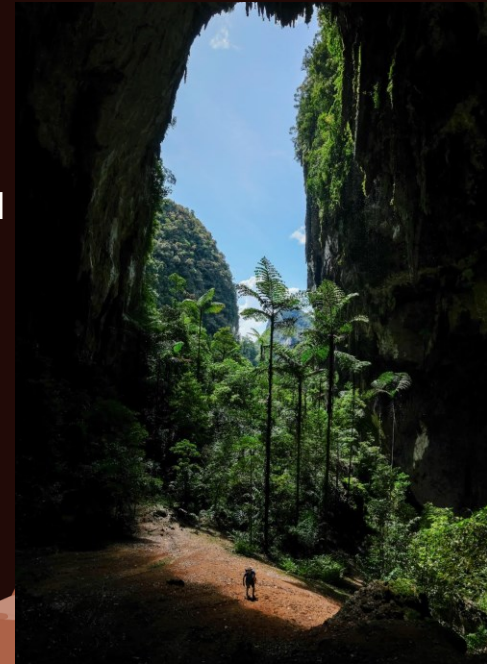
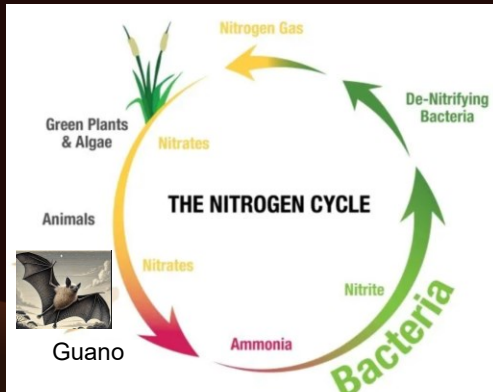


Photo Taken By Hazel Barton

Isotope Ratio Mass Spectrometry to Understand Nitrogen Flow Within Cave



Nitrogen Cycle



Genomic Extraction from Bird and Bat Guano to Understand the Cave Microbiome





Podcast

Isuru Silva

-PhD student studying astrobiology at the University of Alabama.



# Researching Cave Cyanobacteria to Understand How Life Could Survive on Other Planets

Sonication



DNA Extraction



Growth Media Preparation



Interviewed by  
Caleb Crabb

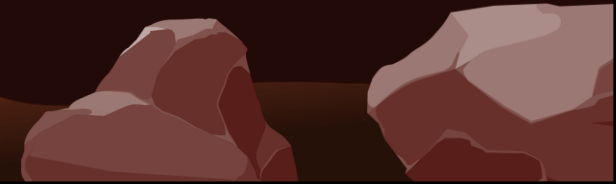
Environmental Sampling



# National Speleological Society National Convention



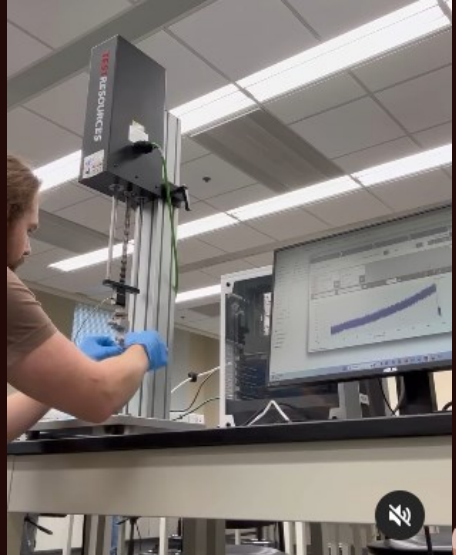
- Research Presentations
- Networking
- Caving Expeditions



# Fiber Testing



Sample	Test	Value	Unit	Notes
1	1	100	g	
2	2	100	g	
3	3	100	g	
4	4	100	g	
5	5	100	g	
6	6	100	g	
7	7	100	g	
8	8	100	g	
9	9	100	g	
10	10	100	g	
11	11	100	g	
12	12	100	g	
13	13	100	g	
14	14	100	g	
15	15	100	g	
16	16	100	g	
17	17	100	g	
18	18	100	g	
19	19	100	g	
20	20	100	g	
21	21	100	g	
22	22	100	g	
23	23	100	g	
24	24	100	g	
25	25	100	g	
26	26	100	g	
27	27	100	g	
28	28	100	g	
29	29	100	g	
30	30	100	g	
31	31	100	g	
32	32	100	g	
33	33	100	g	
34	34	100	g	
35	35	100	g	
36	36	100	g	
37	37	100	g	
38	38	100	g	
39	39	100	g	
40	40	100	g	
41	41	100	g	
42	42	100	g	
43	43	100	g	
44	44	100	g	
45	45	100	g	
46	46	100	g	
47	47	100	g	
48	48	100	g	
49	49	100	g	
50	50	100	g	



We developed a procedure for treating rope fibers and testing them on a tensile testing machine.





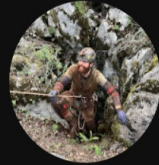
Instagram Reels

# Science Communications



YouTube

Youtube Podcasts and Tutorials



**Caleb Crubaugh**

@johncrubaugh4877 · 12 subscribers · 5 videos

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Videos





**Caleb Crubaugh**  
August 18

I sketched and drafted my first cave! Hopefully the first of many! Thanks to the many people who spent so much time teaching me and their patience while I was learning!

*Cave*

Laguna de Sánchez  
Santiago, NL, Mexico

Survey Date: 11/12/2023  
Drafted by: Caleb Crubaugh 8/16/2024

Scenes and Tape Survey

**Survey Team:**  
Caleb Crubaugh  
Jacob Gambrell  
Nathaniel Hulne

Survey Depth: 18.29 m  
Survey Length: 39.92 m

Proyecto Laguna de Sánchez

**Symbol Key**

	Popcorn
	Flowstone
	Stalactite
	Stalagmite
	Small Square

Profile:

Plan:

Small Squares Possible lead!

4.41° Nt

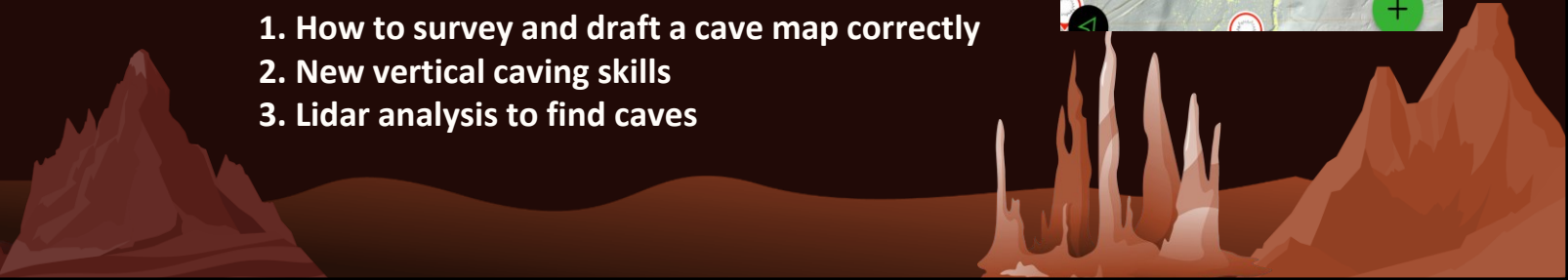
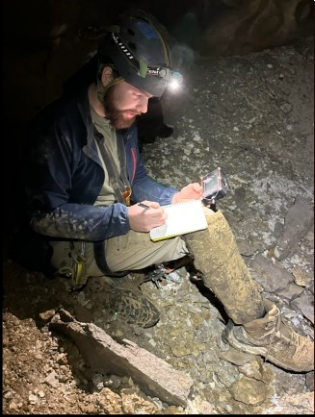
1 5 Meters

# Other Cave Science



## Skills Acquired

1. How to survey and draft a cave map correctly
2. New vertical caving skills
3. Lidar analysis to find caves



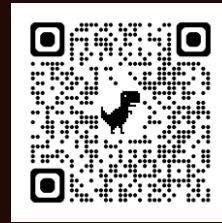
# Conclusion

- Isotope ratio mass spectrometry showed good results
- Gained new skills in cave science and microbiology
- Made progress developing a nuanced method for genomic extraction from bird/bat guano
- Developed rope fiber testing procedure
- Gained experience in science communication

## Acknowledgments:

- Thanks to the Science Influencers Program and Drs. Holli Leggette, Gary Wingenbach, and Barbara Gastel
- Thanks to Dr. Hazel Barton, Max Koether, Jaden Waddell, Nathaniel Friedrich, Isuru Silva, Reilly Blackwell and others at the UA Geological Sciences Department

 Podcasts



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