

# Astrobiology students explore alien environment on Earth

May 25 2015, by Matt Carroll

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Penn State astrobiology students examine a sulfidic cave in Italy where white biofilm grows on the walls. Credit: Kyle Rybacki

Sonny Harman never thought he'd be able to travel far enough to do field work. That's because the Penn State doctoral student studies atmospheres on other planets. But to his surprise, Harman recently stepped into an alien world—complete with environments and life unlike just about anything he'd seen on Earth. And he didn't have to go to Mars to do it. Harman was among a group of graduate students who recently traveled to Italy for an annual astrobiology field course.

Among the other-worldly sights were a series of deep, dark caves where the smell of sulfur filled students' noses and strange organisms grew everywhere, resembling white shag carpeting.

"They are definitely alien terrains," Harman said. "Even caves in Pennsylvania look a lot different than the ones we found in Italy. Some of them are alien, some just really felt like classical Greek literature, traveling into the underworld."

The trip is a prerequisite for graduate students pursuing a dual-title degree in astrobiology. It's a chance for a first-hand look at what lives in the most extreme environments and at ancient examples of life captured in the fossil record. Those experiences will guide the students as they try to answer questions about what early life looked like on Earth and where it may exist elsewhere.

"If we can find the limits for life on Earth, we can use that as sort of a metric for establishing what the limits for life elsewhere in the universe might be," Harman said.

Italy's sulfuric caves are a good place to start, said Zena Cardman, a Penn State graduate student who studies micro-organisms and who also went on the trip. Humans wouldn't be comfortable living there, but certain sulfur-oxidizing bacteria thrive in the environment, creating a biofilm that covers everything.

"We tend to think of the biosphere as being driven by the energy of the sunlight," Cardman said. "But all of these micro-organisms are making a living from reactions based in things underground."

And they could be doing it on other planets, too, even if it doesn't look to be habitable at first glance. From the caves, the whirl-wind tour of Italy took students to beaches covered in brilliant green, purple and brown

stones that were once part of the ocean floor and may show signs of the planet's earliest life, and to travertine quarries that supplied the rocks used to build ancient Rome. If that wasn't enough, they sampled Italian coffee, cuisine, art and architecture.

But the trip was also a chance for students from across disciplines—geosciences, biology and astronomy—to get to know each other better. As part of the astrobiology program, they will work together to answer some difficult questions.

"I have a microbiology background," Cardman said. "But now I know people who are experienced at looking at planetary atmospheres. And if I want to combine my research on the gases that are generated by a microbe with a gas that might be detectable on another planet, now I have a friend I can work with."

Getting to know each other on the trip also helped the students develop a common language, one that transcends the scientific jargon from their respective fields.

"It's a skill that takes practice, but it's required for cross-disciplinary research. It's an essential step in learning how to engage everyone, not just scientist but media and the general public, in what scientists do," said Jennifer Macalady, an associate professor of geosciences, "Those are skills we want students in the astrobiology program to take away with them."

Macalady accompanied the [students](#) on the trip, along with Mike Arthur, professor of geosciences and an associate in the Earth and Environmental Systems Institute. The experience was invaluable to someone like Harman, who didn't get to spend much time in caves with a background in astronomy.

"For some of us, it's the first chance we've had to go out into the field and do lab measurements," Harman said. "Some of us, our field sites are a little far removed. Even going as far as Italy is a short hop in the grand context."

Provided by Pennsylvania State University

Citation: Astrobiology students explore alien environment on Earth (2015, May 25) retrieved 20 April 2024 from

<https://phys.org/news/2015-05-astrobiology-students-explore-alien-environment.html>

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