Researchers harness methane-consuming microbes for use in industrial applications

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White biofilms grow on mine tunnel walls as ancient groundwater seeps from holes in the bedrock almost a mile deep in the Sanford Underground Research Facility. Credit: University of Oklahoma

A University of Oklahoma research team, led by OU Professor Lee Krumholz, is studying methane-consuming microbes from extreme environments that can be re-engineered for industrial applications, such as biodegradable plastics and electricity. OU's role in the collaborative study with South Dakota School of Mines and Technology and Montana State University is to collect microbial samples from extreme environmental sites and to extract DNA and RNA to determine the microbial community composition and the microbial activities that pertain to methane consumption.

"Our work is to isolate and grow novel microorganisms from extreme environments that have unique capabilities and can oxidize methane," said Krumholz. "These will likely be new species of bacteria not previously documented or studied."

Krumholz, a professor in OU's Mewbourne College of Earth and Energy and College of Arts and Sciences, is the OU principal investigator overseeing team members Amy Callaghan, associate professor of microbiology and plant biology; Andrew Elwood Madden, associate professor of geology and geophysics; and Krithivasan Sankaranarayanan, assistant professor of microbiology and plant biology, in their efforts to collect and analyze samples from three sites: (1) Zodletone Spring in southwestern Oklahoma, 120 miles from Oklahoma City; (2) a former gold mine, Sanford Underground Research Facility in South Dakota; and (3) Yellowstone National Park in Montana.

The OU team will analyze groundwater from all three sites to determine the amount of methane and the activities of methane-oxidizing bacteria. The SURF environment is almost a mile underneath the ground in a solid and unusual rock system where microbes can still live. The groundwater contains both nutrients and products of those microorganisms. At Yellowstone, the thermal environments can be extremely acidic with temperatures approaching those limiting microbial life. The Zodletone

Spring has high levels of methane, and OU researchers have been monitoring the microbial activity for some time.

This research also will help scientists in understanding the climatological impact of methane, a potent greenhouse gas, as it is produced and consumed at these sites. South Dakota School of Mines and Technology is developing new tools at the molecular level to the methane oxidation capacity of some microorganisms. Montana State University is interested in developing aspects of previously-developed biofilms that can be applied to new organisms for industrial applications or byproducts.

Krumholz plans to develop a summer undergraduate program to extend science, technology, engineering and mathematics education to Native American students. This program will provide undergraduates and high school students access to research facilities and expertise within this project. Approximately 10 to 20 students from tribal colleges will participate in the one-week program that will involve classroom lectures and a primary emphasis on field and laboratory studies.

Provided by University of Oklahoma

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