Methane-producing microbial communities found in fracking wells

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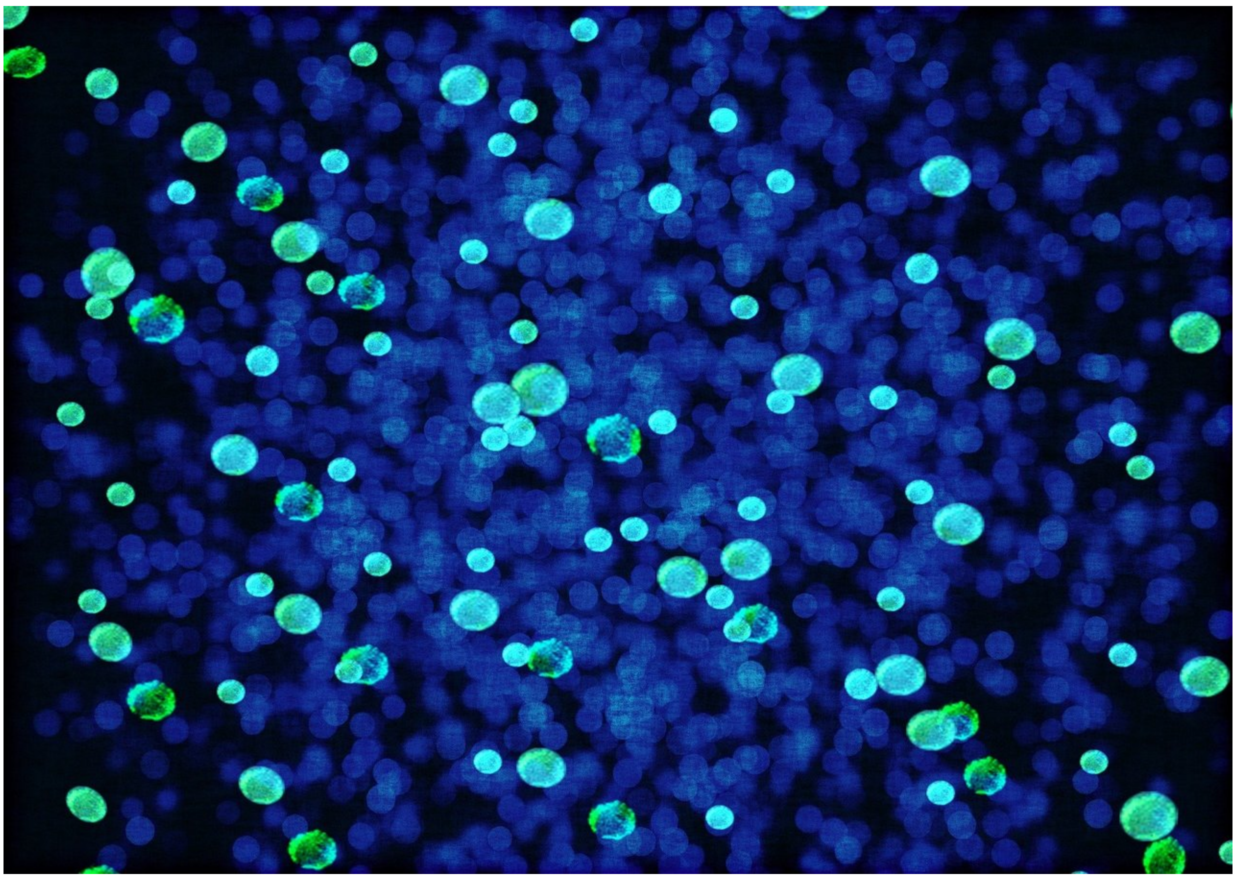

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Deep in the rocky earth, in the liquid-filled cracks created by fracking, lives a community of highly interactive microbes—one that could at once have serious implications for energy companies, human health and scientists investigating the potential for life on Mars.

New research has uncovered the genetic details of microbes found in fracking wells. Not only do a wide array of bacteria and viruses thrive in these crevices created by hydraulic fracturing—they also have the power to produce methane, according to a study led by scientists at The Ohio State University and published in the journal *Proceedings of the National Academy of Sciences*.

That means it's possible that the tiny life forms could create more energy—and from a different source—than the fracking companies are going after in the first place.

On the other hand, the microbes found in samples from wells in Ohio, West Virginia and Pennsylvania could point to potential problems from an industry standpoint—they could prove corrosive, toxic or otherwise problematic, said the study's lead author, Kelly Wrighton, an assistant professor of microbiology at Ohio State.

"Energy companies spend a lot of money and resources trying to get rid of life in these systems," she said.

Hydraulic fracturing involves forcing open fissures in rocks deep in the earth by introducing high-pressure liquid and other components, including sand and chemicals, to extract oil or gas. Chemicals, stabilizers and water injected into the wells is undoubtedly contributing to the microbial diversity within them, the researchers said.

This was the first study to look at microbes from multiple sites in a controlled environment, and presented a rare scientific opportunity, said study co-author Michael Wilkins, an assistant professor of earth sciences at Ohio State.

"These wells are so deep and hard to sample—access to the liquid in the wells offered us a unique opportunity to understand how these microbes make a living in these briny, high-pressure, high-temperature conditions," Wilkins said.

The findings detailed in the study will inform the fracking industry, environmentalists and others. But they also have potential implications much farther from home.

"Finding life in these rocky, salty, hard-to-survive conditions would not be dissimilar to finding life on another planet," said Wrighton, who recently applied for a NASA grant relative to that pursuit.

"If we want to think about what life would be like if it could exist on Mars, this is probably a pretty good place to start."

Previous studies of fracking wells had documented the presence of some microbes and highlighted their ability to make methane, but didn't offer detailed information about how complex the communities are and how they interact, said study co-author Mikayla Borton, an environmental science graduate student in Wrighton's lab.

Those answers came from taking 40 samples from five fracking wells into the lab, manipulating the environment to "draw out" microbes that wouldn't have been identified in a basic field experiment and conducting genomic analyses.

The researchers also added a compound called glycine betaine to the samples and tracked gas release over time, confirming that, when prompted, the microbes produced methane.

"It's really important to know what these organisms can do—to grasp their genomic potential and metabolic interactions—and figure out what impact that might have on the ecosystem," Borton said.

"We found here that multiple wells have similar microorganisms, which are capable of producing methane. In theory, that could mean that stimulating the microbial community in some way could increase energy yields. That's not been done in shale yet, but it's done in other systems, including in coal mining," she said.

Furthermore, the microbes found in the fracking mines have parallels with microbes found in other protein-rich ecosystems, including the human gut and soil, Borton said.

"What we learn about these fracking microbes could have the potential to help answer questions about human health—including how plaque forms in our arteries when we have cardiovascular disease," she said.

More information: Mikayla A. Borton el al., "Coupled laboratory and field investigations resolve microbial interactions that underpin persistence in hydraulically fractured shales," *PNAS* (2018). www.pnas.org/cgi/doi/10.1073/pnas.1800155115

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