

Behind the iron curtain: How methane-making microbes kept the early Earth warm

April 17 2017



Tiny incubators were used to simulate early Earth conditions, tracking microbial diversity and methane emissions over a period of 500 days. Credit: Rob Felt, Georgia Tech

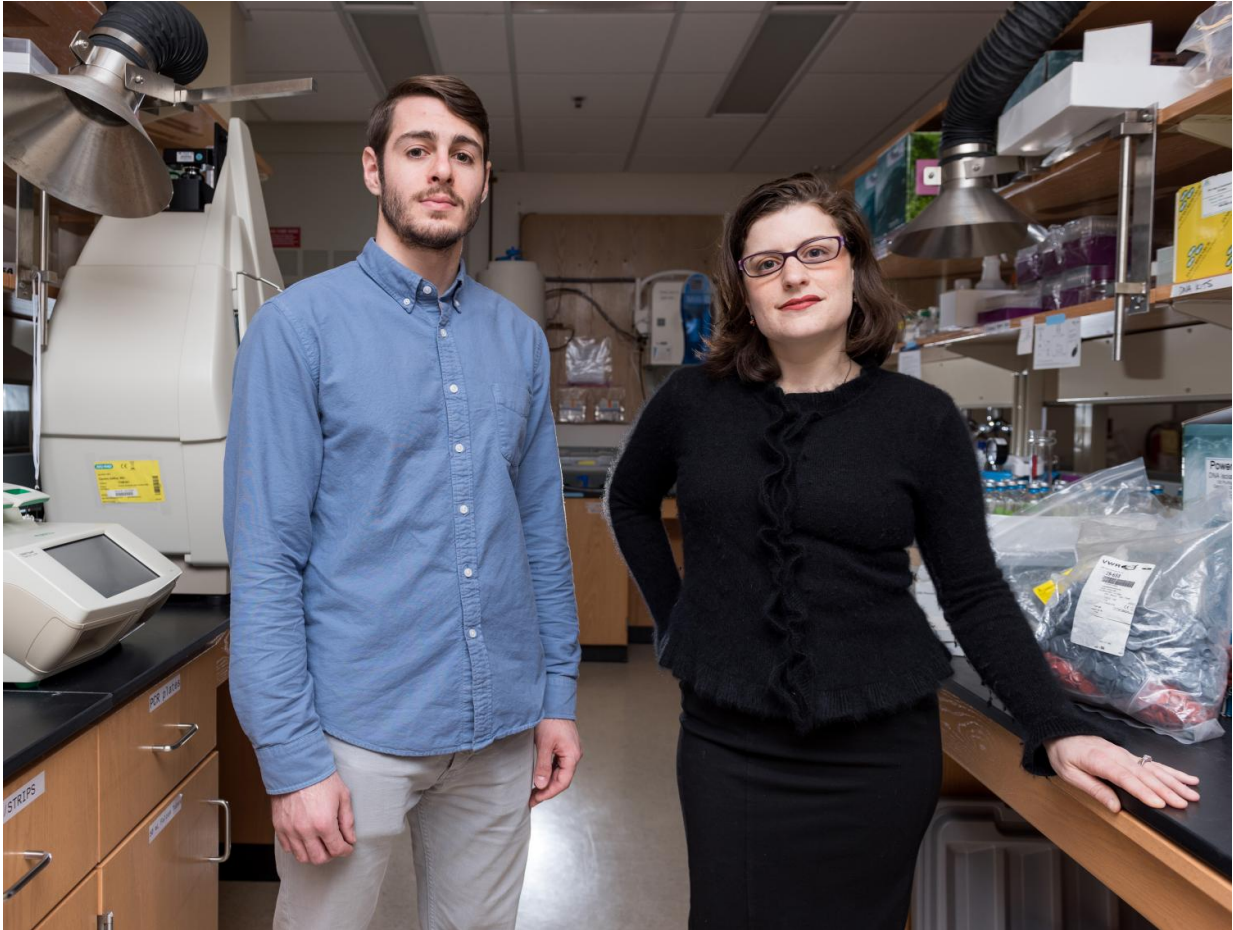
For much of its first two billion years, Earth was a very different place: oxygen was scarce, microbial life ruled, and the sun was significantly dimmer than it is today. Yet the rock record shows that vast seas covered

much of the early Earth under the faint young sun.

Scientists have long debated what kept those seas from freezing. A popular theory is that potent gases such as methane—with many times more warming power than carbon dioxide—created a thicker greenhouse atmosphere than required to keep water liquid today.

In the absence of oxygen, [iron](#) built up in ancient oceans. Under the right chemical and biological processes, this iron rusted out of seawater and cycled many times through a complex loop, or "ferrous wheel." Some microbes could "breathe" this rust in order to outcompete others, such as those that made methane. When rust was plentiful, an "iron curtain" may have suppressed methane emissions.

"The ancestors of modern methane-making and rust-breathing microbes may have long battled for dominance in habitats largely governed by iron chemistry," said Marcus Bray, a biology Ph.D. candidate in the laboratory of Jennifer Glass, assistant professor in the Georgia Institute of Technology's School of Earth and Atmospheric Sciences and principal investigator of the study funded by NASA's Exobiology and Evolutionary Biology Program. The research was reported in the journal *Geobiology* on April 17, 2017.



Marcus Bray (left), a biology Ph.D. candidate and Jennifer Glass, assistant professor in the Georgia Institute of Technology's School of Earth and Atmospheric Sciences, are shown in the laboratory where tiny incubators simulated early Earth conditions. Credit: Rob Felt, Georgia Tech

Using mud pulled from the bottom of a tropical lake, researchers at Georgia Tech gained a new grasp of how ancient microbes made methane despite this "iron curtain."

Collaborator Sean Crowe, an assistant professor at the University of British Columbia, collected mud from the depths of Indonesia's Lake Matano, an anoxic iron-rich ecosystem that uniquely mimics early

oceans. Bray placed the mud into tiny incubators simulating early Earth conditions, and tracked microbial diversity and [methane emissions](#) over a period of 500 days. Minimal methane was formed when rust was added; without rust, microbes kept making methane through multiple dilutions.

Extrapolating these findings to the past, the team concluded that [methane production](#) could have persisted in rust-free patches of ancient seas. Unlike the situation in today's well-aerated oceans, where most natural gas produced on the seafloor is consumed before it can reach the surface, most of this ancient [methane](#) would have escaped to the atmosphere to trap heat from the early sun.

More information: M. S. Bray et al, Shifting microbial communities sustain multiyear iron reduction and methanogenesis in ferruginous sediment incubations, *Geobiology* (2017). [DOI: 10.1111/gbi.12239](https://doi.org/10.1111/gbi.12239)

Provided by Georgia Institute of Technology

Citation: Behind the iron curtain: How methane-making microbes kept the early Earth warm (2017, April 17) retrieved 23 April 2024 from <https://phys.org/news/2017-04-iron-curtain-methane-making-microbes-early.html>

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.