

Microbes May Be Engineered to Help Trap Excess CO₂ Underground

San Diego, Calif. – In H.G. Wells' classic science-fiction novel, *The War of the Worlds*, bacteria save the Earth from destruction when the Martian invaders succumb to infections to which humans have become immune through centuries of evolution. If a team led by researchers at Lawrence Berkley National Laboratory's Center for Nanoscale Control of Geologic CO₂ (NCGC) has its way, bacteria – with a little assist from science – will help prevent global destruction for real by trapping underground a greenhouse gas, carbon dioxide (CO₂), that threatens Earth's climate.

The team discussed its work at the 56th Annual Meeting of the Biophysical Society (BPS) in San Diego, Calif., held Feb. 25-29.

Among the methods being considered for removing excess CO₂ (from sources such as power stations) from the atmosphere is transporting the gas into porous rock deep underground. There, it can mineralize with cations (positively charged atoms) to form solid carbonate minerals and become permanently trapped. This mineralization process, however, is extremely slow, sometimes taking hundreds to thousands of years.

Bacteria, the researchers predicted, might help speed things up.

"Previous studies have shown that underground bacteria remain in the rock after CO₂ injection. We know these microbes can impact how minerals form, leading us to wonder if they also affect the rate of mineralization," says NCGC biochemist Jenny Cappuccio. "And if bacteria could enhance the nucleation of carbonate minerals, then perhaps we could fine-tune that ability in the laboratory."

Using different surface bacteria as proxies for their deeper-dwelling cousins, the researchers first examined the microbes' effect on calcium carbonate formation, and discovered that all of the species accelerated the process. The rate, they report, was highest in microbes whose surfaces have a thin protein shell known as an S-layer.

"We suspected that the negative charge of the S-layer attracted positive calcium ions and brought them in proximity with carbonate," Cappuccio says.

To test this theory, the researchers engineered artificial S-layers and increased their negative charge by attaching a loop of six amino acids – what Cappuccio calls a "loop of negativity." When carbonate was introduced, nucleation was significantly increased.

The next step, Cappuccio says, will be to culture deep subsurface microbes in the lab, make nanoscale changes to increase the negative charge of their surfaces, and see if that "tuning" makes them better able to speed up carbonate nucleation.

ABSTRACT: <http://tinyurl.com/7vql8va>

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This news release was prepared for the Biophysical Society (BPS) by the American Institute of Physics (AIP).

ABOUT THE 2012 ANNUAL MEETING

Each year, the Biophysical Society Annual Meeting brings together over 6,000 research scientists in the multidisciplinary fields representing biophysics. With more than 4,000 poster presentations, over 200 exhibits, and more than 20 symposia, the BPS Annual Meeting is the largest meeting of biophysicists in the world. Despite its size, the meeting retains its small-meeting flavor through its subgroup meetings, platform sessions, social activities, and committee programs.

The 56th Annual Meeting will be held at the San Diego Convention Center (111 W. Harbor Drive, San Diego, CA 92101), located three miles from the San Diego International Airport and less than one mile

from the Amtrak station. The San Diego Trolley has two stops directly in front of the Center at Harbor Drive/First Avenue and Harbor Drive/Fifth Avenue.

QUICK LINKS

Meeting Home Page:

<http://www.biophysics.org/2012meeting/Main/tabid/2386/Default.aspx>

Program Abstracts and Itinerary Planner:

<http://www.abstractsonline.com/plan/start.aspx?mkey=%7B5B4BAD87%2D5B6D%2D4994%2D84CE%2DB3B13E2AEAA3%7D>

ABOUT BPS

The Biophysical Society (BPS), founded in 1956, is a professional scientific society established to encourage development and dissemination of knowledge in biophysics. The Society promotes growth in this expanding field through its annual meeting, monthly journal, and committee and outreach activities. Its 9000 members are located throughout the U.S. and the world, where they teach and conduct research in colleges, universities, laboratories, government agencies, and industry. For more information on the Society or the 2012 Annual Meeting, visit www.biophysics.org.

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