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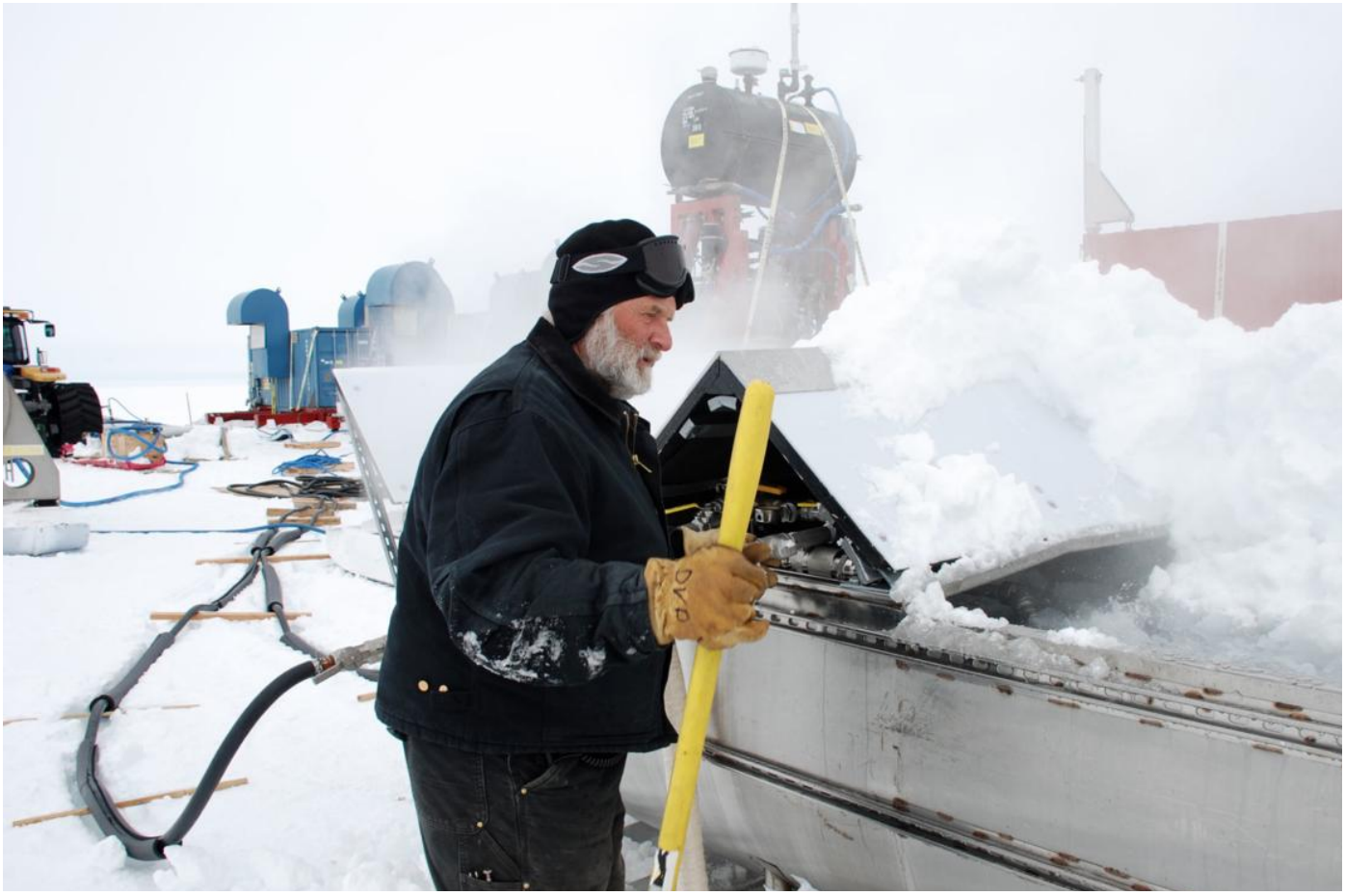
EDITOR'S PICK

# UNL scientists, drillers look for life under Antarctic ice sheet

CHRIS DUNKER Lincoln Journal Star Dec 4, 2018 Updated Dec 11, 2018



Off and on throughout Earth's history, global temperatures have risen to melt enough of one of the largest bodies of ice on the planet to create marine seas teeming with microscopic life.

As the Earth would cool once more — a process that takes hundreds of thousands of years — the West Antarctic Ice Sheet would expand, and ice and snow would again entomb bodies of freshwater on the continent.

But even locked deep in that cold, dark tomb, the ecosystem containing thousands of species of bacteria and viruses continues to thrive.

How microbial life exists in the most extreme environments on this planet — and potentially others — is there deep under the ice.

To uncover their secrets, the University of Nebraska-Lincoln's Antarctic drilling team (ANDRILL) will spend the next few weeks drilling into Lake Mercer, a subglacial lake twice the size of the island of Manhattan under the West Antarctic Ice Sheet, about 500 miles from the South Pole.

The ambitious project, backed by the National Science Foundation, will mark the first time humans have peered into the prehistoric body of water, said David Harwood, a paleontologist at UNL.

“There have been multiple times when the West Antarctic Ice Sheet wasn't present and there was a marine sea across that area,” said Harwood, who oversees UNL's drilling team in addition to being one of the lead scientists on the Subglacial Antarctic Lakes Scientific Access project, or SALSA.

When the ice would go away, the sea would come right in, he added, and with it, a single-celled algae called a diatom that bloomed in marine waters across West Antarctica.

Known to evolve quickly to adapt to their specific environment, the ancient algae also give scientists a time frame for when the marine sea was present through their fossils, which appear as a powdery or dusty substance on rocks and sediments in the sea.

“They are like a field partner who carries with them information about their age and the environment they lived in," Harwood said.

Their ubiquity is important because the diatoms have been a foundational species in the ecosystem in the region for eons, even in places where light can't reach and energy is in short supply.

"The carbon they produced millions of years ago is used as a likely food source," Harwood said. "It did when they were alive and now when they are dead. They are the bottom of the food chain for everything from krill to whales."

If the microbes are discovered to feast upon the organic carbon left behind by the diatoms, Harwood said it could explain one mechanism that caused the Earth to cool after millions of years in a warming period.

"We're trying to sample the sediments and all the bugs that live in them so we can understand that ecosystem, what's coming in and what's going out, what's growing there and what it's feeding on," Harwood said.

But, he added, the team from SALSA won't know until it gets there.

During a 2013 expedition into Lake Whillans — another subglacial lake under West Antarctica — Harwood said researchers identified 4,000 different species of microbes living in a sealed environment under the ice sheet.

Those microbes were discovered to be consuming methane. The ecosystem of Lake Mercer could thrive on methane, too, or a different source of energy altogether, he said.

"It's easy to have a big discovery when you don't know much," he said. "I just want to put some hard data on the table."

Getting that data takes a monumental effort. For months, a team of more than 50, including UNL's drilling team led by head driller Dennis Duling, have prepared for the expedition to Lake Mercer, which requires a convoy of specialized tractors, sleds and ski-equipped aircraft to reach the site.

Once at the site, ANDRILL will bore through 4,000 feet of ice using a hot-water drill — essentially six car wash compressors and boilers — that inject 72 gallons of near-boiling water per minute into a shaft aimed for Lake Mercer.

Upon breakthrough into the subglacial lake, SALSA will deploy underwater cameras to plot sites where sediment cores can be collected and a remote-operated vehicle can explore the deep.

In all, SALSA will have between 10 and 14 days of access to Lake Mercer — even though the project has been planned for years — to collect samples, Harwood said.

The relatively small time frame will give scientists double the sources of sediments, diatoms and microbes in increasing their understanding about life under the West Antarctic Ice Sheet.

The data collected could help the SALSA project clarify some of the less-extreme climate shifts in Earth's past between periods of extreme warm and cold, which would help improve models on the future of climate and ice sheet change.

Changes to the Earth's ice sheets such as those in West Antarctica will have the biggest impact on rising sea levels brought on by climate change, Harwood said.

The depths of Lake Mercer could also give some direction to scientists who use Antarctica to inform future missions to other planets and moons in our solar system.

Kate Craft, a planetary scientist at the Johns Hopkins University Applied Physics Laboratory, said understanding how life exists in extreme environments on Earth furthers discovery of life on a place such as Europa, an icy moon of Jupiter believed to harbor a liquid ocean.

In the orbit of the gas giant, which emits radiation that prevents life from existing on the surface, life could only exist underneath or within the ice sheets that cover the moon.

The only analog currently available to scientists is Antarctica, Craft said.

"Antarctica is one of the best places we have on Earth to do these kind of studies," she said. "We just don't have many places where we can get conditions even vastly similar."

NASA is planning to launch a satellite into Jupiter's orbit to conduct flybys to learn more about Europa, while the European Space Agency is also planning its own mission to Jupiter's moons.

The Europa Clipper, as NASA's project has been dubbed, will dip in and out of Europa's orbit to assess the habitability of the moon, while potentially analyzing for evidence of life if plumes of liquid are being jetted from the ice into space, Craft said.

Unlike Mars, which has exchanged planetary material with the Earth, it's unlikely Earth and Europa have swapped anything in the billions of years since the solar system formed, meaning life would have developed independently there.

If life is found on Europa, Craft said the discovery "would give us further understanding of life itself and how it could be different under different conditions," which in turn would round out what is known about how life developed on our own planet.

"It's not just about finding life somewhere else, but in understanding life here as well."

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