

Sub Makes Unexpected Find Under Floating Ice Shelf

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British Antarctic Survey

A robotic sub found an underwater mountain range beneath Pine Island Glacier.

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A robot submarine has made a surprising discovery under the floating ice shelf of a West Antarctic glacier that recently has been disappearing into the sea with alarming speed.

The yellow submarine found a small underwater mountain range that probably once acted as a speed bump, slowing the flow of the glacier from the West Antarctic ice sheet into the sea.

Looking For Clues

Pine Island Glacier has been flowing down faster in recent decades, which means more ice is melting. That's of concern because, if the West Antarctic ice sheet goes, global sea levels could rise dramatically. And scientists have wondered if what's happening to Pine Island Glacier could be a harbinger of more melting.

So last year, a team of researchers traveled to the glacier on a U.S. research vessel, the Nathaniel B. Palmer, to look for clues that could explain the glacier's

behavior. When their ship arrived at the glacier's edge, they saw a vast wall of ice.

"The face of the glacier that is apparent to us when we're on the boat is 50 meters high," says Pierre Dutrieux of the British Antarctic Survey.

And below the water, he points out, is more ice — the ice wall goes down for about a quarter of a mile. The ice gets even thicker closer to where it connects with the land.

The Yellow Submarine That Could

Below that vast hunk of ice is where the research team sent the Autosub3, an autonomous underwater vehicle about 20 feet long. It carries sensors that can map the ice above and the seafloor below. The sub can also measure things like the salinity and temperature of the water.



British Antarctic Survey

The Autosub, which is about 20 feet long, explored the area under the Pine Island Glacier.

Despite the sub's sophistication, it's all powered by regular old batteries — "basic D-cell batteries, actually, but it's 5,000 of them," Dutrieux says, adding that changing all those batteries can take a whole afternoon.

When it's under the ice, the sub can't communicate with the boat. So if there's a problem, no one can help it — and it could just disappear. That's what happened few years ago, during the first attempts to send an automatic submarine under Antarctic ice: That sub got lost and was never recovered.

This time around, though, the replacement sub successfully ventured beneath the ice on six missions.

"You just give it its mission and send it on its way," Dutrieux says. "Then, you wait something like 24 hours, depending on the length of the mission, and during that time you have nothing else to do but to stress, really."

He says it was always a relief when the sub returned — especially because one time it was all beat up, and the researchers realized it had nearly gotten trapped.

All in all, the robot sub spent a total of about four days traveling over 300 miles beneath the floating shelf of ice.

What The Sub Found

Its discovery of the small mountain range beneath the ice was completely unexpected, says Dutrieux, because he and his colleagues had thought the seafloor would be flat.

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"So we were very surprised to discover this ridge. It was very exciting, actually," he says.

The researchers realized that, in the past, Pine Island Glacier actually sat on top of this ridge, which slowed the slide of ice into the sea.

But in recent decades, the ice melted and thinned enough that it lifted off the ridge. This allowed warm ocean water to creep over the ridge and start eating away a cavity under the glacier, according to a report in the journal *Nature Geoscience*.

"This is a really important step forward," says Richard Alley, a glaciologist at Pennsylvania State University, who called the study "a technological tour de force" and a test case for understanding what could happen to other West Antarctic glaciers in the future.

When it comes to rising sea levels, Pine Island Glacier itself isn't a huge danger, Alley says. "The fact that it's gone over this bump is not the end of the world there, probably."

But neighboring glaciers pose a bigger threat. "The biggest worry is probably the next one over, which is Thwaites," Alley says. "If all of Thwaites were to go, it would make a notable difference to sea level rise."

He says Thwaites Glacier is currently sitting on top of its own big speed bump on the seafloor — so the robot sub's work should help scientists better understand what could happen if that ever changes.