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A robotic submersible surfaces near the *RV Nathaniel B. Palmer* at Thwaites Glacier.

FIRST LOOK UNDER GIANT GLACIER FINDS TROUBLING CURRENTS

If Thwaites Glacier collapsed, it could raise sea levels worldwide by more than half a metre.

By Jeff Tollefson

Taking advantage of rare ice-free waters in West Antarctica last February, scientists got their first look underneath Thwaites Glacier, a massive and increasingly unstable formation perched at the edge of the continent. What they saw only increased fears of a collapse that could raise global sea levels by more than half a metre. Data gathered as part of the International Thwaites Glacier Collaboration suggest that warm water from the deep ocean is welling up from three directions and mixing underneath the ice.

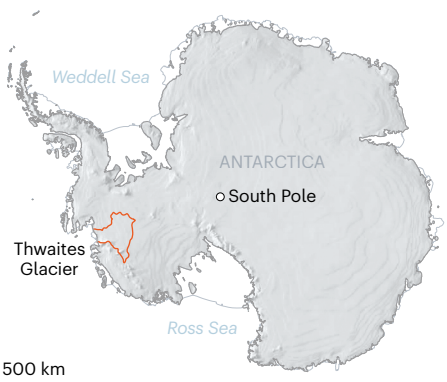
"Thwaites has got these three guns pointed right at it," says Erin Pettit, a glaciologist at Oregon State University in Corvallis and a co-leader of the 5-year, US$50-million project to assess the glacier's stability. "There is warm water coming from all directions." She presented initial results from the first two years of the project last week at the American Geophysical Union's ocean-science meeting in San Diego, California.

The warm currents could further destabilize the glacier, which is as large as the island of Great Britain and holds enough ice to boost global sea levels by an estimated 65 centimetres (see 'A precarious position'). If it collapses, Thwaites could take other parts of the West Antarctic Ice Sheet with it, and become the single largest driver of rising sea levels this century.

Fearing that its collapse has already begun, scientists in the United States and the United Kingdom launched an unprecedented research programme in 2019, involving six field studies and two modelling teams. Pettit's team is focusing on the glacier's ice shelf, which extends across more than 100 kilometres of open ocean and acts as a cork, holding ice back on land. Other groups are studying the glacier's flow on land, and ocean circulation; all the data will feed into the modelling.

A PRECARIOUS POSITION

Thwaites Glacier is perched on the edge of West Antarctica. A catastrophic collapse could raise sea levels by 65 centimetres and promote further collapse of the West Antarctic Ice Sheet.



Drama under the ice

Last year's expedition was the first to actually reach the front of the Thwaites ice shelf, which is usually locked in sea ice. "The conditions were perfect: calm seas, open water," says Anna Wåhlin, an oceanographer at the University of Gothenburg in Sweden who led the underwater work. "We could nearly touch the ice."

The team sent a robotic submersible named Rán — after the Norse goddess of the sea — out under the shelf to gather data about the sea floor, as well as information about ocean conditions and currents.

The shelf is divided into two sections: the more stable eastern side is underpinned by a rocky outcrop and flows at around 600 metres per year, whereas the western side is moving more rapidly, at 2 kilometres per year. The new data suggest that a deep, warm current is rolling along the coast from the adjacent Pine Island Glacier and mixing with other warm currents underneath the eastern shelf. If the eastern side falls apart, Pettit says, the entire equation will change.

Melting hopes

During the Antarctic field season that ended this month, Pettit's team worked directly on the ice shelf. Researchers conducted seismic tests to study the sea floor and drilled through 300 metres of ice to deploy sensors that will monitor ocean conditions for the next two years.

But Pettit says the main surprise this year came from radar data detailing the structure of the ice shelf. Thwaites's underbelly is a landscape unto itself, complete with channels, ridges and cliffs, all crafted by warm currents, she says. "It's not just a flat sheet of ice that is melting uniformly. It's more complex than we thought."

If all goes according to plan next year, Rán will conduct a larger mapping mission all the way to the point at which the main body of the glacier rests on bedrock. Gliders and other instruments will gather as much data as possible about ocean currents and sea-floor topography under the shelf, Wåhlin says.

Wåhlin is confident that by the end of the project, three years from now, her team will have some answers about Thwaites's future. "Then we should know much more about the risks," she says. "It would be shameful if we don't."