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LESSONS FROM THE CHANGING ANTARCTIC OCEAN FLOOR

Relevant for: Geography | Topic: Important Geophysical phenomena - Earthquakes, Tsunamis & Volcanoes

Icebergs in the bay of Rothera. | Photo Credit: Robert Ricker, Alfred Wegener Institute for Polar and Marine Research

The Paris Agreement aims to keep the global temperature rise during this century well below 2 degrees Celsius. But what if this is not followed? Can the worsening climate change completely melt the ice masses of Antarctica? By reconstructing the seafloor of the Southern Ocean, researchers have now mapped how the continent reacted in the past to changes between cold and warm phases.

“In the course of the Earth’s history, the geography of the Southern Ocean has constantly changed, as continental plates collided or drifted apart, ridges and seamounts formed...and melt water transported sediment from land to sea,” says geophysicist Dr. Karsten Gohl from the Alfred Wegener Institute Helmholtz Centre for Polar and Marine Research from Germany in a release. He is one of the authors of the paper recently published in the journal *Geochemistry, Geophysics, Geosystems.*

The team studied nine periods in the climatic and glacial histories of Antarctica, starting from 34 million years ago when the first major continental-size ice sheet of Antarctica was established. They also looked at the mid-Miocene (about 14 million years ago) when the mean global temperature was 4 degrees Celsius warmer than today.

“The early Pliocene period [5 million years ago] had atmospheric carbon dioxide levels which [we can relate to] to today - slightly above 400 ppm - and temperatures are 2 to 3 degrees Celsius higher than at the moment. Looking at our data, we can see that during this period a major glacier system along the East Antarctic coast showed signs of retreat and increased melt water output,” explains the first and corresponding author Katharina Hochmuth in an email to *The Hindu.* She is now at the University of Leicester, U.K.

To reconstruct the past, the team used seismic profile data collected across 40 years from over 150 expeditions. In seismic reflection, sound waves that penetrate the seafloor are emitted from research ships, and using the reflected signal an image is created. The image reveals the different layers below the surface, just like in a slice of cake.

These images were then compared to sediments collected from the corresponding regions, and the age of the layer was determined. In the final step, a computer model calculated which sediment deposits were already present and which came in later to reconstruct the seafloor geometry of the past. These datasets can now be freely downloaded from the AWI’s Earth system database called PANGAEA.

“The true mechanisms behind the various warm periods are still debated, and various factors work together in different feedback-loops. Most important is the carbon dioxide ratio in the atmosphere. The strength and route of the ocean currents transporting heat away from the tropics towards the poles also played a role,” explains Dr. Hochmuth.

The team is currently working on more deep-dives into specific time frames. “We are also looking into older time scales when India was still closer to East Antarctica. There is a lot more

exciting stuff to come," she adds.

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