

NEWS IN FOCUS

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MARIO TAMAYO/GETTY



Beginning in the 1960s, scientists have used radar instruments aboard aeroplanes to study Antarctica's ice.

GLACIOLOGY

Rescued radar maps reveal Antarctica's past

More than 2 million newly digitized images extend the history of the bottom of the ice sheet.

BY ALEXANDRA WITZE
NEW ORLEANS, LOUISIANA

Glaciologists will soon have a treasure trove of data for exploring how Antarctica's underbelly has changed over nearly half a century. An international team of researchers has scanned and digitized more than 2 million records from pioneering aeroplane radar expeditions that criss-crossed the frozen continent in the 1960s and 1970s.

"These are the flights that invented this way of doing glaciology," says Dustin Schroeder,

a radar engineer at Stanford University in California who is leading the new project.

The digitized data extend the record of changes at the bottom of the ice sheet, such as the formation of channels through which water flows, by more than two decades. "All of a sudden it allows us to understand how dynamic the bottom of the ice sheet was — or was not — over that long time period," Schroeder says. The work could also help researchers to get a better handle on how the ice sheet might respond as global temperatures rise.

Schroeder described the findings on

13 December in New Orleans, Louisiana, at a meeting of the American Geophysical Union. The team hopes to publish a paper and get the data online, freely available through the Stanford library, in the coming months.

"Going back in time is exactly what we need to do," says Helen Fricker, a glaciologist at the Scripps Institution of Oceanography in La Jolla, California. "It's a benchmark to compare what the ice sheets were like, with now."

Scientists have used old aerial surveys to chart surface changes in the Arctic and Antarctic, for example by studying ▶

► photographs of Greenland's glaciers to document their history. But peering through ice to the bedrock — which can be hundreds or thousands of metres down — requires seismic surveys or, more typically, radar.

In aeroplane radar surveys, researchers fly over the ice, pinging radar signals downwards and measuring how they bounce off the interface between the ice and the bedrock. The data reveal not only the thickness of the ice, but also whether there are signs of melting such as subglacial lakes or ice accumulations where the flowing ice gets caught on a rough spot in the underlying rock.

In Antarctica, the first widespread radar mapping took place between 1967 and 1979, in a programme run jointly by the Scott Polar Research Institute (SPRI) in Cambridge, UK; the US National Science Foundation; and the Technical University of Denmark in Lyngby. Their scientists flew more than 250,000 kilometres across much of West Antarctica — including the areas draining to the Ross and Ronne ice shelves — and part of East Antarctica, including the famous ice-core-drilling sites Vostok and Dome C.

Scientists used the data to explore Antarctic ice thickness and the distribution of subglacial lakes. But the information mostly sat as rolls of 35 mm, 8 mm and Super 8 film in the SPRI library. Very little of it had been digitized until Schroeder began to wonder about it, and SPRI director Julian Dowdeswell invited him to Cambridge.

Using start-up funds for his Stanford laboratory, Schroeder started looking for experts who could handle old film. He called the Academy of Motion Picture Arts and Sciences in Hollywood, which pointed him to companies that restore film. He bought a specialized scanner, hunted down some of the vintage equipment that he needed on eBay, and flew with two art historians to Cambridge in June 2016. Over the course of 2 weeks, they carefully cut, taped and scanned about 1,000 rolls of archival film.

WHAT LIES BENEATH

Schroeder has already spotted fine details in the data, such as channels beneath ice shelves and accretion plumes where ice has been piling up. These features had been observed before, Schroeder says, “but now that we know we can see them, we’ll look for new ones, too”.

Modern radar mapping of Antarctica didn't begin in earnest until the 1990s, so pushing the data set back another two decades is a significant improvement, he says.

The 1970s data are of such high resolution that they can be used to improve bedrock-topography maps of Antarctica (P. Fretwell *et al. Cryosphere* 7, 375-393; 2013). These are crucial for modellers as they test how ice sheets respond to changing temperatures.

Schroeder hopes soon to digitize similar 1970s radar data for Greenland. ■

BIOTECHNOLOGY

Gene editing staves off deafness in mice

Technique to knock out mutant gene uses fatty molecules to deliver CRISPR components to inner-ear cells.

BY HEIDI LEDFORD

Genome editing has been used to reduce hearing loss in ‘Beethoven’ mice, which carry a mutation that causes deafness in both mice and humans.

The research relies on a technique called CRISPR–Cas9 to knock out a mutant form of the gene *Tmc1*. In doing so, it lays out a potential pathway for treating other genetic causes of hearing loss. It also addresses a major problem facing the field of genome editing: how to deliver the protein and RNA needed for the CRISPR–Cas9 technique into the cells of a living animal.

In this case, the researchers encapsulated the CRISPR components in positively charged fatty molecules called lipids, which are capable of crossing cell membranes. They then injected those particles directly into the inner ears of the mice, where the lipids were taken up by the hair cells that sense acoustic vibrations. The results are reported this week in *Nature* (X. Gao *et al. Nature* <http://dx.doi.org/10.1038/nature25164>; 2017).

The method could be used to enable gene therapy in people, if additional testing shows it to be safe and effective, says David Liu, a

chemical biologist at the Broad Institute of MIT and Harvard in Cambridge, Massachusetts, and a lead author of the study.

That could be an important step forward, says bioengineer Charles Gersbach of Duke University in Durham, North Carolina. “The vast majority of papers that you see where they’re using CRISPR to correct a mutation in an animal model, they are using delivery systems that aren’t applicable to treating diseases in humans,” he says. “Delivery is still a challenge.”

CRISPR–Cas9 gene editing uses the Cas9 enzyme to cut DNA at a site dictated by the sequence of a snippet of RNA, called a guide RNA. To edit genes in the cells of living animals, researchers often use viruses to shuttle in the DNA that encodes Cas9 and the guide RNA. Once inside the cell, the DNA is expressed and the cell produces both components.

But those viruses have been carefully engineered for classical gene therapy, in which they are used to express a normal copy of a particular gene at high levels and for as long as possible. Researchers who are editing genomes instead prefer that Cas9 is expressed for just enough time to make its targeted



Gene editing could one day prevent deafness in people who have a mutation that causes hearing loss.

NACHO DOCE/REUTERS

CORRECTION

The News story 'Rescued radar maps reveal Antarctica's past' (*Nature* **552**, 299–300; 2017) erroneously said that Delft University of Technology in the Netherlands helped to run a radar-mapping programme in Antarctica in the late 1960s. In fact, it was the Technical University of Denmark in Lyngby.