



United States
Antarctic Program



"News about the USAP, the Ice, and the People"

[Home](#) / [Science](#) / [Deep Core Complete](#) (page 1)

The Antarctic Sun

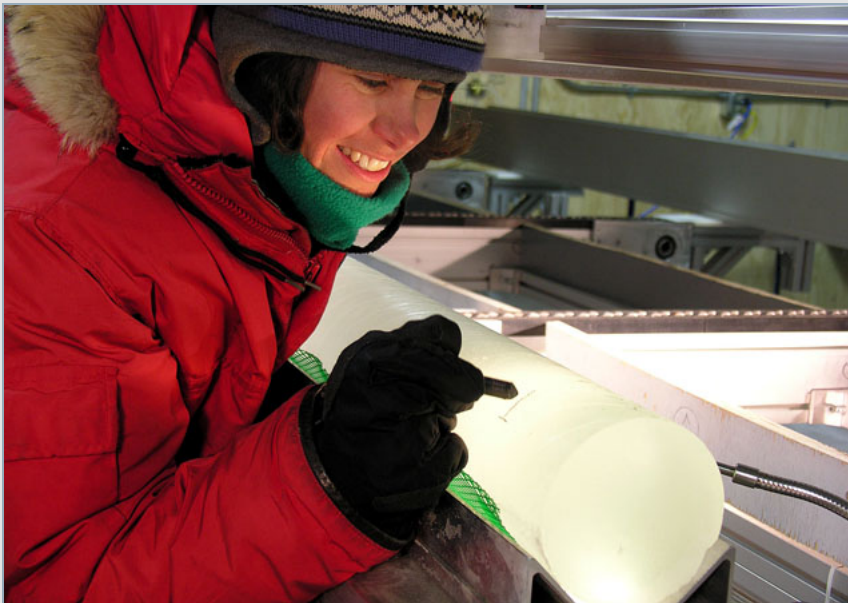


Photo Credit: Kendrick Taylor

Rebecca Anderson, a scientist at the Desert Research Institute, examines an ice core at WAIS Divide during a previous drilling season. The WAIS Divide project completed major coring operations on Jan. 28, 2011, after five years of work, reaching a target depth of 3,331 meters.

Deep core complete

WAIS Divide project finishes five-year effort to retrieve 3,331 meters of ice

BY PETER REJCEK, *ANTARCTIC SUN* EDITOR
Posted January 31, 2011

More than 20 years in the planning.



Storms often prevented planes from arriving for days or more at a time.

In the final weeks, mechanical breakdowns of the drill and the usual weather delays appeared to derail any hopes of reaching the final depth goal for the season of 3,330 meters.

But it happened. It is done. The [U.S. Antarctic Program \(USAP\)](#) has drilled and recovered its longest ice core to date from the polar regions, officially hitting 3,331 meters. It took five years working from a lonely field camp in one of the stormiest regions of the West Antarctic Ice Sheet (WAIS) to extract the ice, which contains clues about Earth's past climate from the last 100,000 years.

The core — drilled at a location dubbed WAIS Divide, a high point on the ice sheet where the ice begins to flow in different directions, akin to the Continental Divide in the United States — is the second-longest ice core ever recovered anywhere. The Russians have the record for the deepest ice core, which they drilled in the 1990s at Vostok Station in East Antarctica, to a depth of 3,701 meters. The previous U.S. record was in Greenland, when scientists reached 3,053 meters on July 1, 1993.

"Not only is this the deepest ice core ever drilled by the U.S., but the fact that we have reached our target depth for this season means that the project is on track to be able to complete the entire ... project schedule," said Julie Palais, program manager for [Antarctic Glaciology](#) in the [National Science Foundation's Office of Polar Programs](#).

"It is wonderful to see everything coming together so nicely. ... It is gratifying for me as the program manager, but also for everyone who has been involved because I know how much work has gone into making it happen," Palais added.

For scientists who will spend the next years, if not decades, analyzing various properties of the ice to understand past climatic and environmental conditions, depth is less important than the timescale

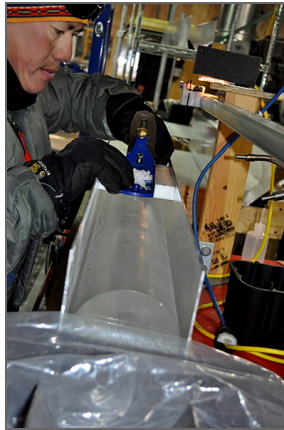


Photo Credit: Mark Twickler

*Scientist Gifford Wong
samples for water isotopes
in a section of ice core.*

represented by the core.

“We did not come here to study the climate of Antarctica — we are here because this is where the information is stored,” said [Kendrick Taylor](#), chief scientist of the [WAIS Divide program](#) from the [Desert Research Institute](#) in Nevada, shortly before the last core came to the surface on Jan. 28, 2011 at 12:24 p.m. (local time).

The last 100,000 years covers the most recent glacial period, when the Earth was cooler, and large ice sheets covered the northern and southern hemispheres. Concentrations of the main greenhouse gas carbon dioxide (CO₂) were much lower than today’s high of 390 parts per million.

In fact, based on other ice cores from Antarctica and Greenland, scientists are convinced CO₂ levels are the highest they’ve been in at

least the last 800,000 years.

Climate scientists are particularly excited about the WAIS Divide ice core because it promises to offer a particularly “high-resolution” record of the past 40,000 years, with thick annual layers akin to tree rings.

“It is the most detailed record from Antarctica covering a long time period,” said [Ed Brook](#), a professor of geosciences at [Oregon State University](#) who has several NSF-funded projects for studying the greenhouse gas concentrations in the WAIS Divide core.

Thanks to the region’s high snowfall rate, there is more ice and more air per year in the core than any other previously collected core. That means scientists can analyze the core in detail, in some cases seeing how year-to-year climate changes unfold.

“That kind of data is critical for understanding how and why climate changes,” Brook explained. [1](#) [2](#) [3](#) [Next](#)

Archived from:

<https://web.archive.org/web/20250716193519/https://antarcticsun.usap.gov/science/2349/>





United States
Antarctic Program



"News about the USAP, the Ice, and the People"

[Home](#) / [Science](#) / [Deep Core Complete \(page 2\)](#)

The Antarctic Sun



Photo Credit: Chad Naughton/Antarctic Photo Library

Support personnel at WAIS Divide unload cargo from an LC-130 aircraft flown by the New York Air National Guard. The ski-equipped Hercs transport all materials and personnel to the field camp in West Antarctica, as well as return the hundreds of meters of ice cores to McMurdo Station, where they are prepared for transfer to the United States.

WAIS Divide ice core expected to yield best greenhouse gas record to date

That detailed record will help answer a slew of questions scientists still have about the relation between CO₂ and changes in temperature. Key among them is the issue of why it appears increased carbon dioxide lags changes in temperature. Subtle, cyclical changes in Earth's orbit are responsible for the natural wax and wane of the ice ages, processes that take place over thousands of years.

“By giving better CO₂ records, with higher time resolution, [the] WAIS Divide [core] should be able to more clearly [show] subtle features that may better help us understand these slower changes,” said [Richard Alley](#), a leading paleoclimatologist from [The Pennsylvania State University](#).

“During the ice ages, there were shorter-lived, sharper climate jumps,” added Alley, a principal investigator on the WAIS Divide project. “Some of these did affect CO₂, so getting high-resolution records should allow us to see how things behaved when the changes were closer in speed to what we're causing, which may be a more useful test of our understanding.”

In addition to the atmospheric gases trapped in the ice, researchers also analyze dust and chemicals found in the 12.2-centimeter-wide cylinders of ice. The dust and chemicals are indicators of past climate, while the gas is a sample of the ancient atmosphere.

Most scientists agree that increases in greenhouse gases like carbon dioxide, as well as the more powerful but shorter-lived gas methane, from human industry are responsible for heating up the planet and causing long-term changes in climate. Shorter-term symptoms include wild swings in weather — extreme winters as well as sweltering summers — and intense storms.

The [United Nations World Meteorological Organization](#), along with [NOAA](#) and [NASA](#), said 2010 tied the year of 2005 as the warmest year yet on record. NASA also announced last year that the past decade was the warmest on record, and the trend has been inching upward for the last several decades.



Photo Credit: Chad Naughton/Antarctic Photo Library
WAIS Divide field camp.

Taylor said that by understanding how natural changes in greenhouse gases influenced climate in the past, scientists would be able to do a better job of predicting future climate changes caused by the emission of greenhouse gases by human activity.

“It is sort of like studying a clothes washer,” he explained. “If you do a few loads of laundry, you learn that the rinse cycle comes after the wash cycle.

“You can also learn about natural climate changes using an ice core to study past climate cycles, which helps us predict what the effect of the carbon dioxide that humans are putting into the atmosphere now will have on the climate system, which is sort of like tossing bricks in the washer along with the clothes.”

Getting a ringside view into the natural cycles of the Earth’s climate is no simple task.

It took most of two Antarctic summer seasons just to construct a semi-permanent field camp 1,600 kilometers from the USAP’s logistical hub at [McMurdo Station](#) , including a large arch to house the drilling operation. All materials and personnel were flown to the site aboard ski-equipped LC-130 aircraft operated by the [New York Air National Guard](#) .

After a pilot hole was drilled in the 2006-07 season, major coring operations began the next year using a special drill that was designed and built by Ice Drilling Design and Operations group, part of the [Ice Coring and Drilling Services \(ICDS\)](#) at the [University of Wisconsin-Madison](#) . The 14-meter-long Deep Ice Sheet Coring (DISC) drill is an electromechanical system capable of cutting and retrieving cores of ice to depths of 4,000 meters.

“This achievement means so much to us because it did not come overnight. It required continuous dedication, numerous sleepless nights, and an extraordinary amount of hard work,” said Alexander Shturmakov, director of engineering and research for IDDO.



Photo Credit: Chad Naughton/[Antarctic Photo Library](#)

WAIS Divide drill system.

[Back](#) [1](#) [2](#) [3](#) [Next](#)



United States
Antarctic Program

The Antarctic Sun



"News about the USAP, the Ice, and the People"

[Home](#) / [Science](#) / [Deep Core Complete](#) (page 3)



Photo Credit: Peter Rejcek

Science technician Tommy Cox measures a section of the WAIS Divide ice core as it begins its journey down the core processing line at the National Ice Core Lab near Denver in 2010. The final sections of the recently extracted core will again go to NICL for slicing and dicing before samples are sent to various institutions for analysis.

WAIS Divide project still has work to do after completion of major coring phase

The completion of the major coring operation is “bittersweet,” said Matthew Kippenhan, WAIS Divide project manager for [Raytheon Polar Services](#), the prime contractor to the NSF for logistical support.

“I’m truly feeling honest excitement about reaching this milestone,” Kippenhan said. “Still, we have another second half that has its own challenges.”

Kippenhan is referring to at least two more field seasons. WAIS Divide scientists plan to send instruments into the open borehole to collect additional information and samples. For example, volcanic ash layers in the surrounding ice detected by borehole logging will be useful for helping date the core.

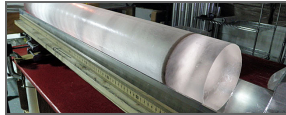


Photo Credit: Heidi Roop

A one-meter-long section of ice core with a distinct ash layer.

By the second season, if not earlier, they also plan to drop down a new type of instrument called a replicate coring drill that the engineers at IDDO are currently designing and building. The smaller drill will fit into the original borehole and core into the side, retrieving additional ice for analysis from layers of particular interest.

The drilling this year stopped about 100 meters above bedrock, as the WAIS Divide scientists didn’t want to contaminate the basal system where ice, rock and water meet.

“The basal water system ... has not been exposed to the Earth’s surface for millions of years, and [may harbor] a unique and pristine biological environment that the U.S. Antarctic Program does not want to contaminate,” Taylor said.

Still, the team may attempt to drill down as much as 40 meters next year if the borehole instruments tell them there is enough ice thickness “cushion” to go deeper without risking penetrating into the environment below.

Kippenhan’s bittersweet moment almost didn’t come this year.

Weather delayed camp opening by several weeks. Then mechanical problems with the drill cost a few more precious days out of the schedule. A five-day extension to the drilling season by the NSF made the difference in the end.

“We are hoping to get as long a record as possible from this site, and getting all of the ice we planned on this year will allow the science community do the work that they are funded to do,” Palais said. “Drilling the ice core is just the first step in the process, albeit a very important one.”

Analysis of the upper sections of the ice core is already under way at institutions and labs across the country.

The NYANG planes carry insulated boxes of the core back to McMurdo Station, where they are stored before being transferred to a cargo ship that visits the research base each February at the end of the summer field season. The frozen cargo is eventually trucked from the west coast to the [National Ice Core Laboratory \(NICL\)](#) near Denver where it is processed for shipment to participating universities. [See previous article: [On the line.](#)]

About 2,000 meters of ice has already passed through NICL. Brook at Oregon State University is awaiting the next — and final — delivery.

“It is really exciting to see this ice coming back to the U.S., and we are really looking forward to the data. Results from the core so far are excellent,” Brook said.

Many of the researchers will be keen to compare their results with those from a core of similar age extracted from Greenland over the last couple of years by a European-led team. However, heavy concentrations of dust in the Greenland ice affects the CO₂ measurements, making the WAIS Divide core that much more valuable to scientists like Brook.

“The drilling crews and everyone involved in the whole logistics and science operations, from the U.S., through to McMurdo, to the camp itself, deserve a huge amount of credit for making this happen,” he said. “There were lots of obstacles, and pulling it off is a major achievement.”



Photo Credit: Peter Rejcek

*WAIS Divide chief scientist
Kendrick Taylor at NICL in
2010.*

NSF-funded research in this story: Kendrick Taylor, Desert Research Institute, [Award Nos. 0944191](#), [0440817](#), [0440819](#) and [0230396](#). For a complete list of all funded projects related to the project, see the [WAIS Divide webpage of funded projects](#). The [WAIS Divide Science Coordination Office](#), based at the [University of New Hampshire](#), manages the day-to-day operations of the project.

[Back](#) [1](#) [2](#) [3](#)

Archived from:

<https://web.archive.org/web/20250716193516/https://antarcticsun.usap.gov/science/2351/>