Frozen to the core

National Ice Core Lab keeps thousands of years of ice in stock

By Mark Sabbatini
Sun staff

All the king's horses and all the king's men had it easy. Imagine putting the pieces of a 450,000-year-old ice block together again.

Now imagine a work area where the temperature is always –13F and you have a good idea of how John Rhoades spends his workday at the National Ice Core Laboratory in Denver. He helps preserve one of the world's most unusual collections: 13,000 one-meter-long tubes of ice carefully extracted from Earth's polar regions.

"I'm in there six hours typically on an eight-hour shift," he said.

The laboratory offers a first-hand look at hundreds of thousands of years of history from some of the world's most mysterious places. Researchers ever-so-carefully gather and send the ice here, then have pieces cut out with band saws, examine them in on-site labs and arrange to have samples sent worldwide. At the same time they expect to have their frozen treasure maintained in perfect condition for years to come.

"Our number one focus is to keep the place cold and organized," said Eric Cravens, an assistant curator at the lab.

Rhoades, another assistant curator at the facility, is the only worker with extensive experience drilling ice cores in Antarctica, having put in three seasons on projects outside of his lab work. He is also known as a good "puzzler" – someone who can put the pieces of frozen history back together accurately – a necessary skill since the ice cores can fragment in the field as well as being sliced up in the lab.

"Sometimes the pressure in the core was so bad the core would literally explode when we got it to the surface," he said, referring to a season at Siple Dome where the ice was particularly "brittle." He said bubbles in the ice several hundred meters down made it fragile – a problem that can happen anywhere – shattering some cores into as many as 50 pieces.

Four employees and two interns work at the 8,000-square-foot laboratory, which is run by the National Science Foundation and the U.S. Geological Survey. An 80,000-cubic-foot freezer features row after row of floor-to-roof shelves stocked with ice cores sorted by area, age and date collected.

"That's the bottom of the Greenland ice sheet," Cravens said, pointing to one of the thousands of identical aluminum-coated cardboard tubes housing the ice cores. A few aisles over are samples of ice up to 450,000 years old from Lake Vostok ("pretty

See Icecore on page 10

Photo by Melanie Conner/The Antarctic Sun

"It's amazing how stupid you can get in the cold."

—Eric Cravens, assistant curator at the National Ice Core Lab

Eric Cravens, assistant curator at the National Ice Core Lab, holds up a piece of ice taken from above Lake Vostok. The clear ice is coated with brown kerosene used as a drilling fluid.

Icecore From page 9

boring stuff," Cravens jokes) and tucked away on a far shelf are samples drilled at Little America V during the International Geophysical Year in 1957 when the first year-round research stations opened in Antarctica.

The NICL collection is divided about evenly between Antarctica and Greenland, with a few cores from the South Cascades in Washington. The Greenland ice sheet has a theoretical maximum age of about 250,000 years, while Vostok holds the honors for longevity in Antarctica.

Reading ice cores is both a simple and complex process. At its simplest level, researchers can count layers of ice like rings on a tree to determine its age. Lighter areas generally signify clear ice and colder seasons, while darker colors indicate warmer periods where higher concentrations of dust managed to infiltrate and cloud up the ice.

At a more complex and microscopic level are numerous projects examining ice samples for evidence of life, atmospheric conditions of the past, volcanic activity, detailed climate data and other information. Trapped gas molecules, dust particles and other elements provide the clues.

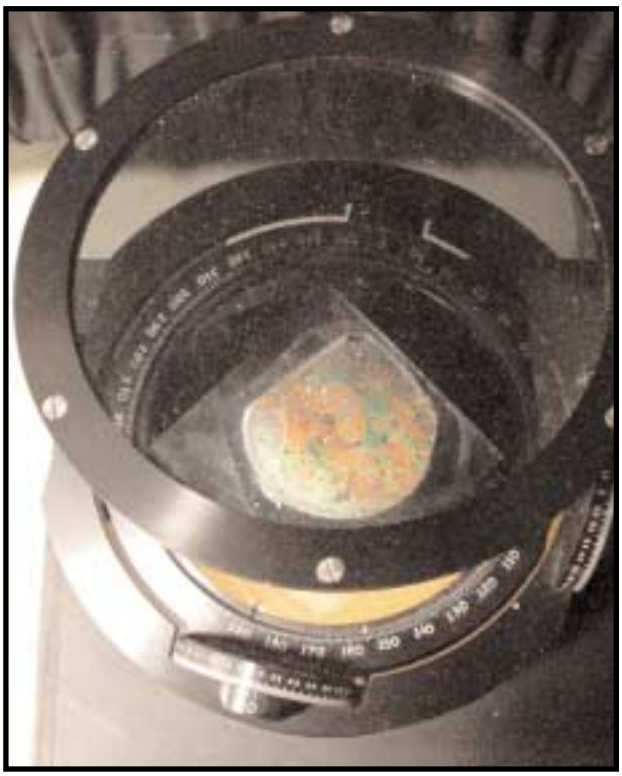
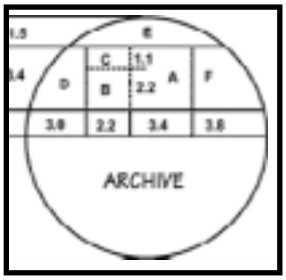


Photo by Melanie Conner/The Antarctic Sun

Viewed through a polarized lens, a slice of clear ice becomes a mosaic of color. Below, a butcher-style diagram shows the standard cuts made into the ice core.



The laboratory workers don't perform any research on the samples, although they are knowledgeable enough to discuss them in great detail. But for Rhoades, who has forgotten most of the geology he learned in college while becoming an expert in glaciology and climatology, the things he enjoys most are working in the field and cutting up the cores at the lab.

"For me it's the challenge of trying to get accuracy for the scientists," Rhoades said.

The biggest problem is probably ensuring all of the measurements and depths recorded in the field are accurate, Rhoades said. Being off a mere four inches (10cm) near the surface can result in significant inaccuracies when ice is extracted further down, since 1,000 years worth of layers can be compressed into a meter of ice at the bottom of the sheets.

There's also the matter of making sure everyone involved knows which end of the ice core is up – otherwise history is literally inverted.

An attempt to standardize collection and storage procedures has started during the past few years, but Rhoades said it will likely be several more years until they take effect. A conference attempting to solidify such standards is scheduled next year in Milan, Italy.

"It's going to be fairly important, I think, for the ice core community and the world," he said. The "community," he added, probably numbers about 200 to 250 people worldwide.

The lab monitors the shipping of the cores carefully. Those from Antarctica are brought in cold storage cases to Port Hueneme, Calif., then brought by freezer truck to Denver – with a second empty truck following in case the first fails.

Preserving the integrity of the ice cores at the lab requires skill and extremely precise, reliable equipment, since any amount of thawing can seriously alter their makeup. The main storage area is kept at –35C (-31F) to slow the inevitable changes in the cores over time to a virtual standstill. An attached lab area at –22C (-13F) has band saws and other tools to dissect portions of the cores, plus research space for scientists and others studying the ice.

The freezer has several layers of backup. A generator comes on within 30 seconds of a power failure and other safeguards can keep it running indefinitely if necessary.

The amount of time people can spend in the freezers varies and the workers and researchers keep an eye on each other, Cravens said.

"When you're working in there for an extended period of time it's amazing how stupid you can get in the cold," he said.

The freezer has an unusual, but somewhat familiar smell visitors often have trouble identifying. The reason, Cravens said, is a fluid used when drilling ice cores is also used in paint, nail polish "and in very small quantities for banana flavoring."

The sample sizes sought by researchers can vary from a short, stubby piece to one a few centimeters wide that extends along the entire length of the core. A committee of five or six people reviews and approves requests to examine core samples, with anywhere from 20 to 50 submitted in a typical year.

Those with NSF-funded grants to do core research are essentially automatically approved, but a member of the general public will have a tougher time gaining access, said Todd Hinkley, acting technical director of the center.

"People off the street, we'd turn them down flat" if they simply walked in and asked to examine the cores, he said, "but we'd also tell them 'We're not turning you down, we're telling you how to do it through the board.'"

Those wanting a more informal look at the lab and an overview of ice core research will have an easier time. The lab encourages and offers tours, with students, seniors, glaciologists and "people from Indiana on a road trip" among the recent visitors, Cravens said.

"Last year we gave tours to over 1,250 people," he said.

The number of people who do research on ice cores is relatively small, but they realize their work may have a significant effect, such as uncovering the true potential threats of global warming or being able to predict weather patterns decades into the future. It's one of the reasons lab workers want people to know about the research performed in their freezer of ice.

"Global warming isn't a policy," Rhoades said. "It's something that's happening that could affect a billion people."