Deepest core drilled from Antarctic Peninsula; may contain glacial stage ice

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Researchers here are hopeful that the new core they drilled through an ice field on the Antarctic Peninsula will contain ice dating back into the last ice age. If so, that record should give new insight into past global climate changes.

The expedition in early winter to the Bruce Plateau, an ice field straddling a narrow ridge on the northernmost tongue of the southernmost continent, yielded a core that was 445.6 meters (1,462 feet) long, the longest yet recovered from that region of Antarctica.

And while remarkably successful, the field work tested the researchers' resilience more than most of their previous expeditions.

"It was the field season from hell," explained Ellen Mosley-Thompson, professor of geography at Ohio State University and leader of the project. "Everything that could go wrong did, and almost everything that could break did."

Bad weather delayed their transport to the remote drill site and snowstorms were a recurrent problem, preventing support flights in to the team. Twice, their drills became stuck deep in the ice, a drill motor broke and all three of the drill gearboxes failed, causing them to cannibalize those devices to construct a new one.

Their ice core drilling effort was part of the much larger Larsen Ice Shelf System, Antarctica (LARISSA) project, designed to unravel past climate conditions in this part of the continent and monitor current ocean and atmospheric processes to better understand what likely caused portions of the massive Larsen Ice Shelf to disintegrate in 2002.

This large, interdisciplinary National Science Foundation project involved experts in the oceanography, biology and geology of the region, in addition to the ice core effort. The goal is to build a climate history of the region, hopefully determining if the ice shelf break-up was part of a long-term natural cycle or linked to the recent warming in this part of the world.

After an earlier team of LARISSA researchers had used ground-

penetrating radar to map the bedrock under the ice field, and identified a suitable drill site, the six-person team was flown to the Bruce Plateau from the British research station, Rothera, on the west side of the Antarctic Peninsula.

Arriving at the location, the team set up sleeping tents, a cook tent and the large geodesic dome that protected the drilling and core processing operations. The team began drilling on New Year's Eve, December 31, 2009.

Two days later, the team had drilled 140 meters (459 feet) when the drill became stuck in the ice. Leaving that drill in the ice, they began drilling a second hole and by January 21, they had retrieved 383 meters (1,256 feet) of core before that drill also became stuck.

They modified a device normally used to bale water from the drill hole to carry ethylene glycol (antifreeze) down to the top of the stuck drill. After several days, the drill broke free and drilling resumed.

"The guys on our team, Victor Zagorodnov and Vladimir Mikhalenko, engineered through each problem that arose and were really very creative," explained Mosley-Thompson, a researcher with Ohio State's Byrd Polar Research Center.

On January 28th, the team reached the bedrock at the bottom of the ice sheet. The same day, they recovered the first drill that had become stuck in early January. Both ice cores were cut into roughly 1-meter-long segments that were packaged in plastic sleeves and cardboard tubes and stored in a snow pit adjacent to the drilling dome.

Periodically, as weather allowed, the planes would come pick up the ice-filled tubes, packed in insulated boxes, and return them to freezers at Rothera. Still stored at the Rothera station, the cores will be transferred

to the U.S. research ship Nathaniel B. Palmer, shipped to the U.S. West Coast and brought to Columbus by refrigerated truck. The cores are expected to reach Ohio State by mid-summer.

When the ice arrives, researchers here will begin their analyses, measuring oxygen-isotopic ratios - a proxy for temperature, and concentrations of dust and various chemicals - including volcanic tracers, that collectively will reveal past climate conditions.

They're hoping for answers to some specific questions:

- Have the climate trends around the Antarctic Peninsula been similar or dissimilar to those experienced by the rest of the continent? Some evidence has suggested conditions have been considerably different;
- Was the climate on the peninsula warm during the early Holocene period, some 8,000 to 6,000 years ago, as it was elsewhere around the globe?
- Can evidence trapped in the ice cores shed light on what caused the Larsen Ice Sheet to begin to disintegrate in recent years?
- Do the cores contain ice formed during the last glacial stage, or "ice age"? If so, it might yield clues to what caused the change from those earlier, much colder climate conditions.

"My gut feeling is that the ice at the Bruce Plateau site might have built up during the latter part of the last glacial stage," Mosley-Thompson said.

"But to date, only two cores drilled in the Antarctic Peninsula, one in

2007 to 363 meters depth by the British Antarctic Survey, and ours, have the potential to answer that question and neither has been analyzed yet to make that determination."

Along with Mosley-Thompson, Zagorodnov and Mikhalenko, other members of the team included Roberto Filippi, Thai Verzone and Felix Benjamin Vicencio Maguina.

Provided by The Ohio State University

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