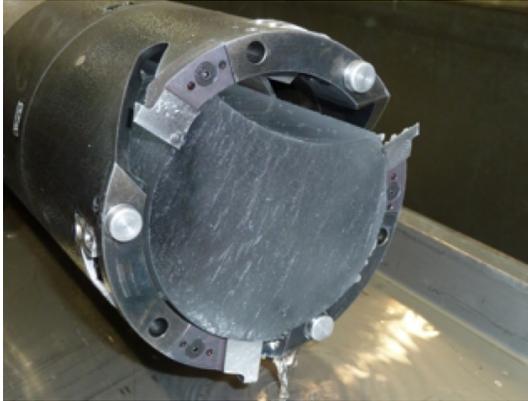


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Innovations in Ice Drilling Enable Abrupt Climate Change Discoveries

A revolutionary drilling system leads to the retrieval of additional ice for evidence of abrupt climate change from the Antarctic Ice Sheet.



On Monday, 17 December, 2012 at 2:10 PM IDDO successfully drilled and captured the first meter of replicate ice from 3001 meters depth in the WAIS Divide Ice Core borehole in West Antarctica. The first replicate core was ~80% of a full round core, but as the drilling continues on the new path 100% round cores will be obtained. Credit: Jay Johnson, University of Wisconsin-Madison.

Deep within ice sheets in the polar regions is an archive of evidence about the climate of the past. Ice cores drilled in the past have yielded amazing scientific discoveries, for example that climate can change abruptly in less than ten years, and that the CO₂ in the atmosphere now is higher than evidenced from the last 800,000 years. At the WAIS Divide site, a cold area of the West Antarctic Ice Sheet where the abundant snowfall rarely melts, the ice contains many tens of thousands of years of annual information about past climate. At specific depths in the ice sheet, including from times of abrupt climate change in the past, scientists are investigating past greenhouse gas records and other evidence from the ice that will help to understand why and how abrupt changes occur.

Now, for the first time, significant innovations in drilling engineering are providing scientists with replicate ice cores from targeted depths and directions in the ice sheet. The newly developed, state-of-the-art Replicate Coring System is capable of retrieving additional ice cores from specific

depths on the uphill side of the main borehole. Engineering that addresses priority science needs for ice coring and drilling is provided by the National Science Foundation (NSF) through a collaborative arrangement through the Ice Drilling Program Office (IDPO) led by Dartmouth, in collaboration with the University of New Hampshire and the Ice Drilling Design and Operations (IDDO) group at the University of Wisconsin. The Replicate Coring technique, developed and tested by the IDDO engineers as part of the DISC Drill, is now producing the first-ever replicate ice cores from a nearly vertical main ice borehole. The Wisconsin group started the design of the DISC Drill in 2002 in response to the desire of the US science community for a deep coring drill that would incorporate the ability to retrieve additional cores from deviations from the main borehole. The DISC Drill was put into service at WAIS Divide during the 2007-08 Antarctic field season and completed the main borehole during 2011-12 reaching a depth of 3,405 meters. Testing of the Replicate Coring System began at the end of the 2011-12 season.

Jay Johnson, the Lead Drilling Engineer for the endeavor says "There was a bit of uncertainty after we drilled the first replicate core whether we had actually recovered it in the core barrel. After waiting a half hour for the drill to return to the surface from 3002.6m, the drill team and core handlers assembled in the drill arch were dead silent as we watched the drill tower tilt and waited for the first glimpse into the drill head. A loud cheer erupted at the sight of the core! It was a surreal moment for the drill team and especially for the IDDO engineers, Nicolai

Mortensen, Chris Gibson, and myself, who developed the technology and hardware for the world's first robotic ice coring drill. This is truly an engineering marvel and a new chapter in ice core drilling that will lead to new scientific discoveries. "

"A stupendous accomplishment! The IDDO engineers have succeeded at a feat that presented many difficulties, all of which they have overcome by dedication, ingenuity, skill, and just plain hard work. They have broken new ground in the ice coring business with the first directed deviation from a main borehole with a suspended electromechanical drill. This opens a new door for the future of ice core drilling. Our heartiest congratulations go to the whole IDDO crew at WAIS Divide." says Charlie Bentley, the P.I. of IDDO.

"The realization of replicate coring at WAIS Divide has been the result of a lot of ingenuity and hard work by the staff of IDDO. The success of effort to retrieve replicate cores was far from certain and was only possible because of the interest and confidence in the project and IDDO shown by Julie Palais the NSF Program Manager, and Chief Scientist for the WAIS Divide project Kendrick Taylor, Lead Scientist for Replicate Coring Jeff Severinghaus, and numerous other scientists interested in ice cores", said Don Lebar, IDDO Program Director.

"The Replicate Coring success is the result of a long journey in engineering development, working toward the attainment of very aggressive and sometimes seemingly impossible goals", says Alex Shturmakov, DISC/Replicate Coring Project Manager of IDDO.

"This is a great accomplishment! It is clear that all of the hard work on everyone's part has paid off." says Dr. Julie Palais, Program Manager at NSF.

This engineering achievement, which was funded by NSF investments in a new paradigm for ice core drilling through the IDPO-IDDO enterprise (EOS Trans AGU, 91(39), 345-346, 2010) is important for the scientific discoveries that are critical to the future of all people. NSF manages the U.S. Antarctic Program through which it coordinates all U.S. scientific research on the southernmost continent and aboard ships in the Southern Ocean as well as related logistics support.

Source:

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Related Websites:

U.S. Ice Drilling Program: <http://www.icedrill.org/>

WAIS Divide Ice Core: <http://www.waisdivide.unh.edu/>