

Collaborative Research: Climate, Ice Dynamics and Biology Using a Deep Ice Core from the West Antarctic Ice Sheet Ice Divide (I-477)

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Field Team:

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Don Voigt

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Field Season Summary:

After a ~16-day weather delay, RPSC opened WAIS Divide via Basler on November 8 with a seven person put-in team. Thanks to Don Voigt's efforts in McMurdo we were able to get a skeleton crew of two drillers (Kristina Dahnert and Jim Koehler) into WAIS Divide earlier than planned, which turned out to be critical in helping us make up some of the lost days. These two drillers worked with the RPSC carpenter crew to assess damage sustained by the Arch over winter and began repairs on the Arch structure and the drill slot.

Drilling operations started on December 16, only about a week behind schedule, at 2,566 meters depth. Throughout the season the DISC Drill routinely produced 20+ meters per day of perfect 3+ meter long cores. There were several instances during the season when there were potential season-ending problems with the DISC Drill, including a kinked cable. In each instance, however, the IDDO engineers and drillers were able to overcome the problems and kept us drilling with a minimal amount of drill "down time". Due to the delayed camp opening and challenges encountered with the drill, the drilling was extended through January 29th, five days later than originally planned. On January 28th the season's depth goal was reached at 3,331 meters (10,928 feet) – making the WAIS Divide Ice Core the deepest ice core ever drilled by the U.S. and the second deepest ice core ever drilled by any group.



The WAIS Divide project completed major coring operations on January 28, 2011, after five years of work, reaching a target depth of 3,331 meters making the WAIS Divide ice core the deepest U.S. ice core ever drilled and the second deepest ice core ever collected.

Photo Credit: Jay Johnson

Date Taken: January 28, 2011

Acknowledgements:

Many people were part of the team that made this possible, and some of them really stepped up this field season. Nicolai Mortensen was at WAIS Divide a month longer than planned. At several times the success of the season depended solely on his brain and hands. Jay Johnson, Kristina Dahnert and Gifford Wong relentlessly pushed to get to the depth goal while keeping the crew in good spirits during stressful times. Paulene Roberts kept the camp running smoothly and well integrated with the coring operations. Julie Palais was our advocate in McMurdo and in Washington D.C., enabling the project to get more than its share of attention, including the season-saving five-day extension.

Physical Properties of the WAIS Divide Deep Core (I-168-M)

[NSF-OPP supported](#)

PIs: Richard Alley (Pennsylvania State University) and Kurt Cuffey (University of California-Berkeley)

Field Team: John Fegyveresi

Season Objectives:

To monitor the physical properties of the WDC06A core, document any obvious changes or deformation, record additional site information from observing snow pits and photographing surface evolution, deploy various temperature monitors, and record insolation data.

Season Note:

John Fegyveresi deployed on November 18th as a member of the I-477 ice-core science tech group. Work that was done related to I-168 was done as a second priority to this project and was accomplished during non-working hours and drill down-time.

Field Season Overview:

John Fegyveresi deployed to Antarctica on schedule, and first prepared cargo in McMurdo for project I-477. During this time, John also prepared various science equipment for monitoring temperature and insolation data at WAIS Divide. Following several days in McMurdo, he arrived at WAIS Divide on December 1st. For the first two weeks there, he worked as a part of the I-477 crew palletizing and preparing ice cores from the 09-10 season for shipment. After shift, over several days, John dug a 2-meter backlit snowpit and sampled it for density and water isotopes. This pit was also extensively photographed in order to capture the stratigraphy. In addition to this pit, John set up several temperature sensors around the camp at various depths in the surface and covered with various solar shields. This was done in order to capture an accurate account of near-surface summer firn temperatures at WAIS Divide. John also installed a custom-made insolation monitoring station that consisted of a long-wave net radiometer and two short-wave pyranometers. This was left recording for the entire season so that the data could be combined with those from the on-site automatic weather station in order to conduct a proper net energy balance survey for WAIS Divide. Lastly, John observed and documented various surface crusting, glazing, cracking, and frosting events over the 2 month long season. After primary ice-core drilling began on Dec 16th, John also monitored and documented any obvious changes in physical properties in the ice cores or if any deformation was observed.



Fig. 1: Net radiometer and double-pyranometer setup. Photo: John Fegyveresi.



Fig. 2: Digging snow pit. Photo: John Fegyveresi.



Fig. 3: Pointing at an obvious thick crust in the snow pit backlit wall Photo: John Fegyveresi.

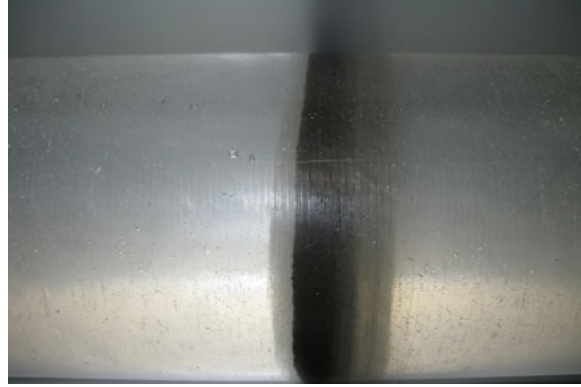


Fig. 4: Distinct ash layer in the WDC06A core. Photo: John Fegyveresi.

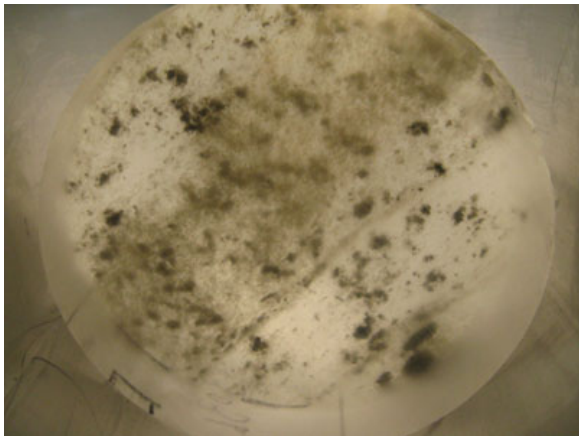


Fig. 5: A patchy/splotchy ash layer. Photo: John Fegyveresi.

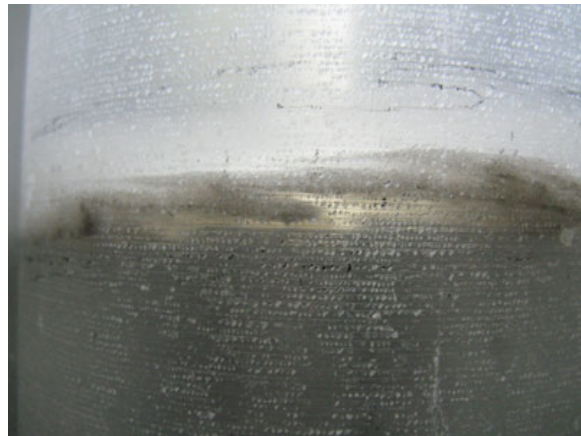


Fig. 6: A possibly folded ash layer – this gave us evidence that deformation was starting to become a factor in the core. However, no evidence of large disruptions were observed. Photo: John Fegyveresi.

Ice Drilling Design and Operations (IDDO) Activities at WAIS Divide 2010-2011 (T-350)

[NSF-OPP supported](#)

PI: Charles Bentley (University of Wisconsin-Madison)

Field Team:

Patrick Cassidy
Krissy Dahnert
Dave Ferris
Chris Gibson
Josh Goetz
Mike Jayred
Jay Johnson
Jim Koehler
Jay Kyne
Nicolai Mortensen
Elizabeth Morton
John Robinson
Steve Polishinski

Field Season Overview:

IDDO operations at WAIS Divide this season began on November 22 with the arrival of Lead Driller Kristina Dahnert and Driller Jim Koehler. All remaining drillers arrived onsite by December 17th, except for Jay Johnson who arrived onsite on January 5th, 2011, at which point he took over as Lead Driller for the remainder of the season. During the first few weeks onsite, the drill crew worked to re-assemble drill equipment that had not wintered over as well as to install upgrades to equipment and software. These activities coincided with Arch facility excavation and repairs.

The first core was drilled on December 16th from a depth of 2566m. Challenges this season pertained mainly to electronic components and redesign of motor control components in the field proved successful. Another challenge encountered this season pertained to the drill's weight-on-bit (WOB) sensor. Due to the failure of this sensor as well as the drill impacting a floating chunk of ice in the borehole, a kink developed in the heavy-duty fiber optic drill cable and communication was lost with the drill. The cable was quickly re-terminated in the field and drilling resumed. Despite numerous challenges, many borehole depth records were broken and the WAIS Divide hole surpassed GISP 2 as the deepest U.S. borehole ever drilled.

Because of the delay in the opening of WAIS Divide camp due to inclement weather, drilling was extended five days and the borehole depth goal for the season was reached on January 28th at a depth of 3331.538m. The DISC Drill produced high quality core throughout the season.

Packing and winterizing of the drill system was completed over the next three days. To facilitate camp closeout, drill staff was reduced in stages and all drillers had departed WAIS Divide by February 2nd.