Little Dome C

Beyond EPICA Oldest Ice Drilling Site (75.29917 °S, 122.44516 °E)

Situation Report #29; Saturday 31 December 2022

Personnel @LDC:
Saverio Panichi (ENEA, Camp Leader), Frank Wilhelms (AWI, Chief Driller), Matthias Hüther (AWI), Gunther Lawer (AWI), Martin Leonhardt (AWI), Andrea de Vito (ENEA)

Personnel @DC: Markus Grimmer (UNIBE), Florian Krauss (UNIBE) , Romilly Harris Stuart (LSCE) , Robert Mulvaney (BAS, Chief Scientist), Giuditta Celli (ENEA) , Johannes Lemburg (AWI) , Michele Scalet (ENEA), Julien Westhoff (NBI)

Weather at LDC 5 pm: sunny, 10 knots, 642 hPa
Meteo at DC 5 pm: T = −34°C, Wind = S, 10 knots, Wind Chill T = −50°C (wind chill warning issued)

Arnold deployed; New Year's Eve celebrations

After the last few days of disappointing drilling, the drillers gathered for a 0800 discussion on how to improve our progress. For the last few days, we have failed to penetrate the ice, despite apparently bringing the full weight of the drill onto the drill head which is something we normally would avoid. Fundamentally, the drill system is working well in the sense that all components are working to specification. And ice core drills work…. Between us, we've decades of experience with drilling ice, and the type of drill design is very similar to the deep and intermediate drills we've all used successfully in the past in fluid filled boreholes.

So, why can we not make progress here? Possibilities include that we have accumulated a large quantity of un-recovered chips in the hole, that we have debris (such as a lost screw – we still miss one from the broken hatch of several days ago), or that the drill is hanging from either the anti-torque skates or the upper drill alignment pins. We concluded that we should take a staged approach today – we would first filter the full depth of the fluid-filled hole, then try to recover any debris in the hole, then gradually loosen the drill in the borehole.

The first stage was to filter the hole: the drill head was replaced by a flap valve, and the valves on the upper and lower chip chamber configured to allow a passive flow of fluid through the filters in the chip chamber. The drill was then lowered down the full fluid column at about 12 cm per second (this is pretty boring!).

Meanwhile, we radioed Concordia, and called for them to bring Arnold to us as soon as possible.

The filter run brought up little in the way of chips – just a couple of kilograms. A normal drill run produces about 15 – 20 kg of chips, so the fluid column was clean, and accumulated chips were not our problem. Our second run of the day was an attempt to drill a core, but we only succeeded in penetrating 34 cm. We did observe (as we had on the filter run) that the drill was 'stick/slipping' in the hole near the bottom, a sure sign that the full weight of the drill might not be on the drill head.

By the time we had finished the filter run and short core, Vito had arrived from Concordia in the Arctic Truck with Arnold. Although nearly 40 km away, the truck can get to us in as little as 45 minutes, and we were grateful to Vito for appreciating out need and coming out to us so quickly after our call.

Time for Arnold… Arnold is actually a hardened steel cone cutter, and for some reason several of us from different nations seem to have the same name for this cutter. Mounted in place of the normal drill head, the cutter makes a downward pointing cone shaped cup in the ice at the bottom of the borehole. Any debris in the hole then falls into this cup, and the next run of the drill with a normal drill head should cut the normal annulus around the cup, and any core brought up should have a cone-shaped indentation in the top and any debris sat in the cone.

Arnold – the hardened steel cone cutter designed to isolate any debris in the borehole into a cone-shaped indentation on the top of the next ice core drilled. (Photo: Mulvaney, Leica SL2-S, 50mm, 1/100, f11, ISO400)

The result: the next attempt at a core brought up a decent 2.21 m core, but just a small amount of plastic, no screws, and nothing that ought to have prevented the drill penetrating the ice. The following core was drilled with slightly less bend on the anti-torque skates to reduce the grip of the blades on the borehole wall, and to reduce the 'stick/slip' descent of the drill near the bottom of the hole. This produced another long core at 2.75 m – perhaps we had begun to solve our penetration problems!

Later in the afternoon, several of us de-camped to Concordia for the evening's New Year celebrations. The camp effectively split in two for the night, with six in Concordia, and six remaining at Little Dome C. We drove to Concordia with the two PistenBullys, taking with us a trailer with 15 full boxes of ice cores to place in the cold storage tunnel there.

Naturally, a fantastic meal was served at both Concordia, and at the Little Dome C camp. The late-night party was perhaps a little rowdier at Concordia! But we all saw in the New Year in tremendous place, with a great bunch of people.

Happy New Year to you all!

Markus and Lemmie carry an ice core box from BELDC into the Tubosider storage cave at Concordia Station. The tunnel is about 10m under the surface, and maintains a year-round temperature of around -50°C. The boxes on the right are ready for processing, while those on the left have been worked on sit on the left ready for shipping to Europe. (Photo: Mulvaney, GoPro Hero11, 3mm, 1/160, f2.5, ISO1000)

End of day statistics:

Individual runs of the drill were recorded as: 0.34, 2.21, 2.75 m

Drillers' depth:	391.93 m;	daily total 5.19 m
Loggers' depth:	396.66 m;	daily total 5.29 m
Processors' depth:	128.0 m;	unknown

RM and FW, 02 Jan 2023