Little Dome C

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

Situation Report #26; Wednesday 28 December 2022

Personnel @LDC:
Saverio Panichi (ENEA, Camp Leader), Frank Wilhelms (AWI, Chief Driller), Robert Mulvaney (BAS, Chief Scientist), Giuditta Celli (ENEA), Romily Harris Stuart (LSCE), Matthias Hüther (AWI), Gunther Lawer (AWI), Johannes Lemburg (AWI), Martin Leonhardt (AWI), Michele Scalet (ENEA), Julien Westhoff (NBI), Andrea de Vito (ENEA)

Personnel @DC: Markus Grimmer (UNIBE), Florian Krauss (UNIBE)

Weather at LDC 5 pm: cloudy, slight snowfall early in day, sunny later, 3 to 5 knots, 641 hPa
Meteo at DC 5 pm: T = −27°C, Wind = SW, 5 knots, Wind Chill T = −37°C

The day the hatch broke, and disappointing drilling

After the recovery of the missing screw yesterday evening, we had high hopes that drilling would improve this morning, and the first run of the day suggested at first this might be the case, but the run ended short with no penetration. As we began lowering the drill into the borehole for the third run, the hard-plastic hatch cover broke into pieces. Martin spotted it in time and went down the inclined trench to recover two large pieces of plastic teetering on the lip of the borehole.

Some explanation is needed here: the drill itself is up to 13 m long depending on the configuration of the barrels being used. It hangs from a 14 m long tower that rotates from the vertical (for drilling) to the horizontal (for pulling out the inner barrel to recover the ice core). The pivot point is about 1 m above the drill tent wooden floor, which means that when it rotates to the vertical it needs a slot in the ice below the floor about 6m deep. We call this the inclined trench – a slot in the ice about 1m wide that follows an arc from the surface to the well-head (the top of the borehole), and has steps on each edge to allow us access to the bottom. The well-head is the entry point for the drill into the borehole and is connected to a 120 m deep fiberglass tube (the borehole casing) that lines the upper part of the borehole. We drill in a fluid filled hole: below about 105m, the ice is non-porous, so the fluid is retained in the hole; above that point the ice is porous (we call this the firn layer) and any liquid in this upper layer would drain away. At the well-head, we have a pipe from the surface that delivers fresh fluid to the borehole, which is needed as we drill deeper, and to replace the liquid that is retained and brought to the surface within the drill each time we make a run. This fluid runs down inside the casing to the non-porous ice. Covering the borehole is a hatch to prevent anything falling into the borehole (it's surprising what makes its way to the bottom of the inclined trench: today we recovered pieces of plastic from the drill, one pipe clip, a paper template, a squeezy bottle of isopropanol and a 2 m folding wooden measuring stick). The hatch is opened to allow the drill entry, then closed behind it. It was this hatch that disintegrated this morning on being opened.

Martin had the task of working at the bottom of the inclined trench for about an hour to replace the hatch. One further thing to note: the temperature at the bottom on the trench is about -35°C – not a comfortable place to work.

Martin at the bottom of the inclined trench, replacing the broken hatch on the borehole well-head. The photo is taken of the image on a video display in the drillers cabin that takes a video feed from a camera trained on the well-head. We normally use this display to monitor the safe entry of the drill into the borehole. Above Martin's head hangs the drill, while to his left is a ventilation shaft that sucks away the drilling fluid fumes that otherwise accumulate at the bottom of the trench.

Martin emerges from the inclined trench, tools in hand, after repairing the broken well-head hatch with a new piece of polyethylene that should cope with the temperature at the bottom of the trench. (Photo: Mulvaney, Leica SL2-S, 70mm, 1/125, f7, ISO400)

Hatch repaired, we continued drilling with high hopes, but this second run also ended without being able to penetrate further into the ice. Our feeling was that the drill was rotating at the anti-torque blades (the uppermost part of the drill – three spring blades that are designed to stop the drill body rotating in the borehole so that the motor drives rotation only of the core barrel and the drill head cutters). Changes to the blades gave us a run of 2.20 m, and a feeling of relief. But sadly, that was the only run of the day that was successful, and we struggled all day with lack of penetration of the drill head into the ice.

At the end of a very frustrating day (and well past midnight) the long 4 m barrels were replaced by the 3 m barrels that had proved effective in the few days before Christmas in the hope that we could return to a configuration that might prove more successful.

End of day statistics:

Individual runs of the drill were recorded as: 1.37, 0.0, 2.20, 0.93, 0.33, 0.55, 0.34, 0.18, 0.08 m

Drillers' depth:	376.20 m;	daily total 6.17 m
Loggers' depth:	381.06 m;	daily total 6.15 m
Processors' depth:	128.0 m;	unknown

RM and FW, 30.12.2022

(Note from the editor: my sincere apologies to Markus and Julien whose names I had mis-spelt in earlier SitReps.)