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The Danish Replicate Drilling System –Results from the First Field Test

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We report on the successful test of a new replicate drilling system for ice cores. The test was done in drill fluid, at 140 m depth of the EastGRIP borehole in central Greenland.
To drill a replicate ice core with the Danish Replicate Drilling System, three steps need to be done. First, we determine the orientation of the borehole, to drill the replicate core on the "downhill"side of the borehole. Access to the parent borehole remains possible, but difficult, as gravity guides downhole tools into the new borehole. As a second step, we broach a groove into the "uphill"side of the borehole. This groove will guide the milling tool during the third step. The milling tool is guided and pushed by a spring, here an antitorque blade, into the "downhill"side of the borehole. We mill the side of the borehole and produce a ledge. We rest the drill on the ledge with all its weight to verify that the milling tool has deviated from the borehole. Our test stops here, as deviation from the parent borehole has been achieved and future logging of the EastGRIP parent borehole remains possible. To produce replicate cores, one would now mount the ice core drill and continue drilling. The drill gradually deviates into the side of the borehole, first producing crescent moon cores, then full-diameter ice cores.
Following the test in the EastGRIP borehole, a new broaching tool has been designed. The new design will improve chip clearing around the cutting tool and include failsafe features.

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