



Clean Sampling of Englacial Meltwater at Greenland Summit

Using a Recoverable Ice Melt Probe

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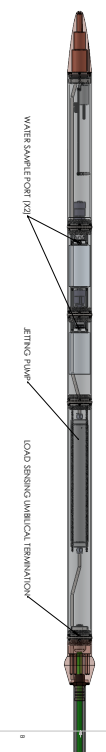


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Synopsis

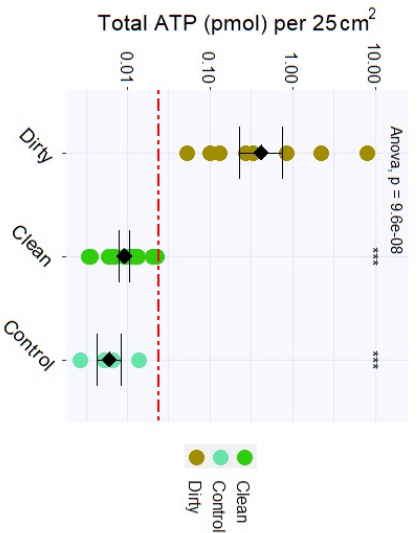
- Melt probe technology is essential for access to oceans on icy worlds in the outer solar system, and...
- ...is key to exploration of terrestrial analog environments at affordable logistical cost.
- Microbiologically clean sampling and (on Earth) sample recovery are key to astrobiological exploration.
- We have in May 2021 demonstrated probe recoverability and clean acquisition of a 120 ml englacial meltwater sample from 103 m depth in ice at -31C – stay tuned for sample analysis
- This opens a path to exploration of en- and subglacial environments at kilometer depths.

University of Washington Ice Diver Melt Probe



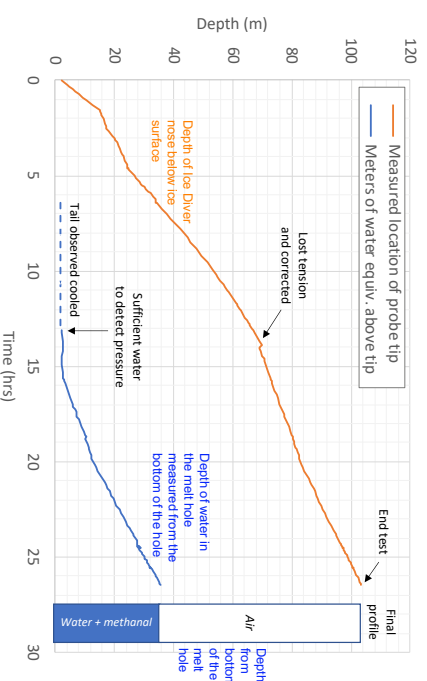
- H₂O₂-based exterior cleaning methods based on Mikucki et al. (2021).
- Peristaltic pumps, autoclaved sample bags and tubing within the Ice Diver (cf. left)

Pre-Deployment Cleanliness



We measured ATP on-site in an Arctic Oven tent immediately after sample collection. Results from these assays indicate that the Ice Diver entered the borehole cleanly! ATP measurements from the probe surfaces were below the NASA “threshold cleanliness limit” of 2.3×10^{-11} mmol ATP per 25 cm² established for the Mars Science Laboratory.

Progression to 103 m Depth, Sample Acquisition, and Probe Recovery



Melt water created as the probe descends initially spreads into firm around the hole, but at 67 m depth water began to accumulate. We used an anti-freeze (methanol), injected several meters above the sampling ports, to keep the hole open. We acquired a melt water sample at 95-97m depth and reached 103 m before recovering. 36 hours later we again lowered the probe through the full length of the hole and again recovered it.

REFERENCE: Mikucki, J.A., C.G. Tartlet, M. Chua, R. Davis, A. Parelli, D. Ghosh, G. Francke, M. Feldmann, C. Espe, D. Heinen, B. Daechwald, Joachim Clemens, W.B. Lyons, S. Talaczky, and the MIDGE Science Team. Field-based planetary protection operations for melt probes: validation of clean access into the Blood Falls, Antarctica englacial ecosystem, *in revision for Astrobiology Journal*, 2021.

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