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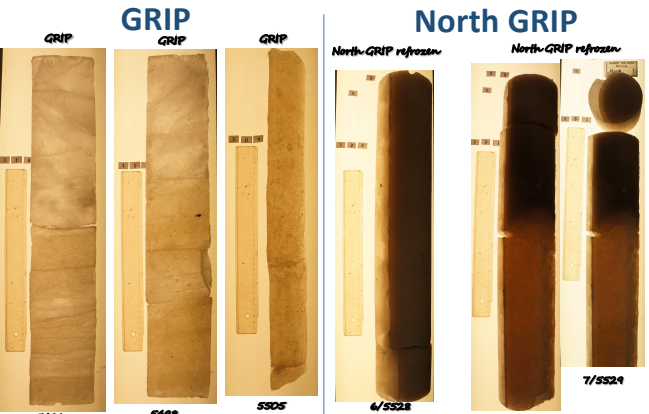
A Census of Basal Ice Samples from Deep Ice Cores at NBI

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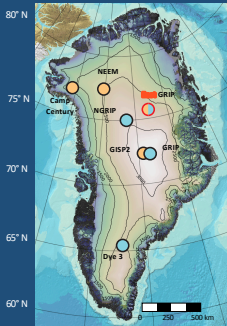
Introduction

- Basal ice from ice sheets comes back to the forefront of glaciological paleoclimatic research, with the new challenges of drilling the “Oldest ice” in Antarctica, as scientists are eager to decipher climatic changes that occurred across the Mid Pleistocene Transition.
- Pioneer work on basal ice showed that this material is challenging. Basal ice has often been altered and modified from interactions with the bedrock. This is also the most dynamical part of the ice sheet, where shearing and folding is likely to have profoundly modified the climatic stratigraphy. Biological processes, in these extreme environments, are also likely disturbances of the original climatic signature.
- Being closer to the bedrock, basal ice is an interesting candidate for deciphering initial conditions of the ice sheet growth, and detecting potential waxing and waning episodes in the course of the ice sheet history.
- Detecting these events in Greenland has already been (scarcely) attempted using a suite of chronometers, both in the ice and the basal sediments (Amino Acid Racemization, Optically Stimulated Luminescence, ¹⁰Be/³⁶Cl, ⁴⁰Ar/³⁹Ar, In-situ cosmogenic (²⁶Al, ¹⁰Be) – e.g. Willerslev et al., 2007; Bender et al., 2010; Schaefer et al., 2016; Christ et al., 2021). Results are however still suffering from large uncertainties due to bedrock contaminations, changes in temperature regimes, unambiguous interpretation schemes, and have limited spatial distribution.
- The present basal ice census at NBI was suggested as a pre-requisite to future work aiming at a better understanding of the history of the “health status” of the Greenland ice sheet, to see what the possibilities are, with the available ice core and subglacial sediment material.



Bender et al., 2010, *EPSL*, doi:10.1016/j.epsl.2010.09.033; Schaefer et al., 2016, *Nature*, doi:10.1038/nature20146; Willerslev et al., 2007, *Science*, doi:10.1126/science.1141758; Christ et al., 2021, *PNAS*, doi.org/10.1073/pnas.2021442118.

Which glacio-geological material is presently available from Greenlandic Deep ice Cores, for reconstructing Ice Sheet inception, waxing and waning?



Locations of the main Greenland ice cores



A “sea” of ice core boxes in the NBI storage freezer



Dr. J.-P. Steffensen proudly exhibits a jar with sediment sample from the first deep drilled Greenland ice core: Camp Century 1963-1966



Cutting Camp Century sediment sample 1063-7 with the ULB diamond wire saw stored at NBI facility

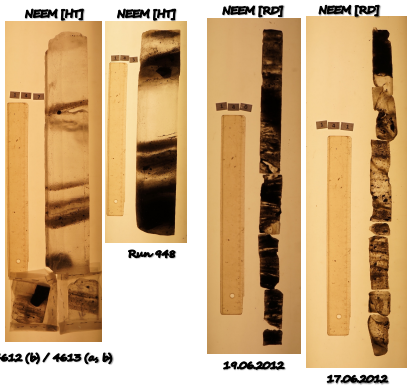


Cut face of Camp Century sediment sample 1063-7

THE FINAL “SHOPPING LIST”

ICE CORE	Remarks	Total length (m)	Total weight (kg)	Minimal debris weight	Mean debris weight	Maximal debris weight
Summary DYE-3		2706.50	3787.45	0.01 percent	1.739 0.24 percent	5.156 0.90 percent
	total length in meters	2707	17.19 total weight in kg	0.002	0.005	85.937
Summary DYE-3 / 7981		2310.80	7449.66	7.449	22.347	372.453
	total length in meters	2311	36.46 total weight in kg	0.007	0.022	0.173
Summary all DYE-3		5017.30	9107.11	9.168	22.580	458.391
	total length in meters	5017	91.08 total weight in kg	0.009	0.028	0.168
Summary GRIP		565.50	17961.30	0.01 percent	1.796 0.10 percent	53.884
	total length in meters	566	17.96 total weight in kg	0.002	0.018	0.254
Summary NEEM Hans Tausen		411.50	15405.00	0.1 percent	11.405 1 percent?	3083.150
	total length in meters	414	13.41 total weight in kg	0.013		3.083
Summary NEEM Rock Drill		982.30	6010.85	6.011	13.822	2382.486
	total length in meters	983	9.83 total weight in kg	0.006	1.182	
	total length in meters without refrozen	9.87	2.45	0.002	0.168	
	total length in meters without refrozen and C	9.74	2.45	0.002	0.163	
Summary all NEEM		1505.80	22159.55	22.140	5096.407	
	total length in meters	1506	22.16 total weight in kg	0.022	5.099	
	total length in meters without refrozen	15.10	18.60	0.019	4.277	
	total length in meters without refrozen and C/S	15.96	18.60	0.019	4.272	
Summary Camp Century cores		1755.50	36853.75	0.001 percent	0.244 percent	0.90 percent
	total length in meters	1756	36.85 total weight in kg	0.001	82.449 0.088	321.084 0.132
Summary Camp Century sediments		852.00	41180.10	41.180	24708.060	
	total length in meters	852	41.18 total weight in kg	60 percent?	24.708	
Summary all Camp Century		2107.50	78033.85	78033.85	24796.500	
	total length in meters	2108	78.03 total weight in kg		24.797	
Summary all NORTH GRIP refrozen		431.50	26828.00	0.03 percent	0.048	
	total length in meters	432	26.83 total weight in kg	0.008		
Summary all BYRD		491.00	22624.50	12 percent	2714.940	15 percent
	total length in meters	491	22.63 total weight in kg	3.755		3393.475 9.994

NEEM

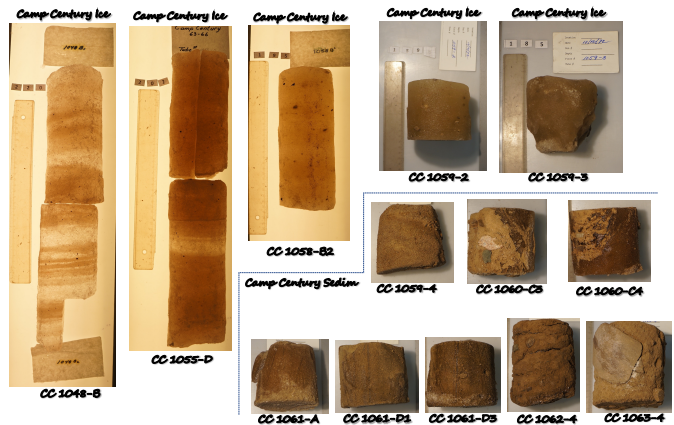


Drilling chips 2012

DYE-3



Camp Century



The Antarctic “Brother”: BYRD

