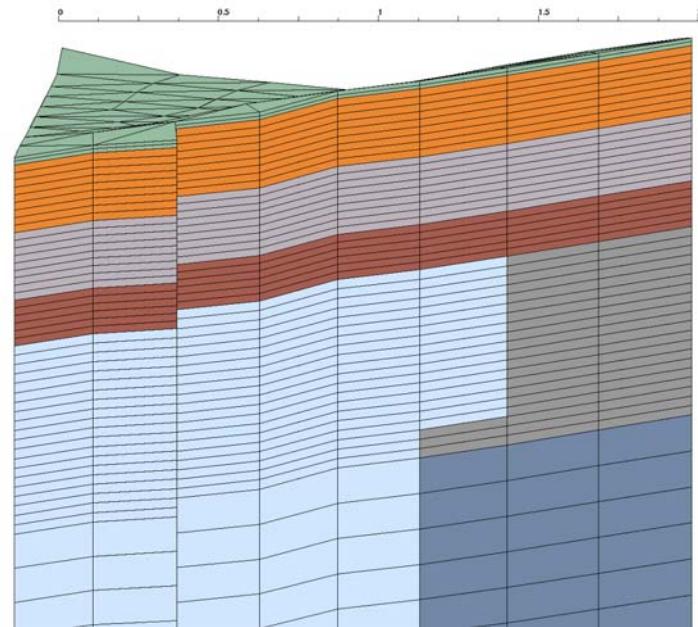
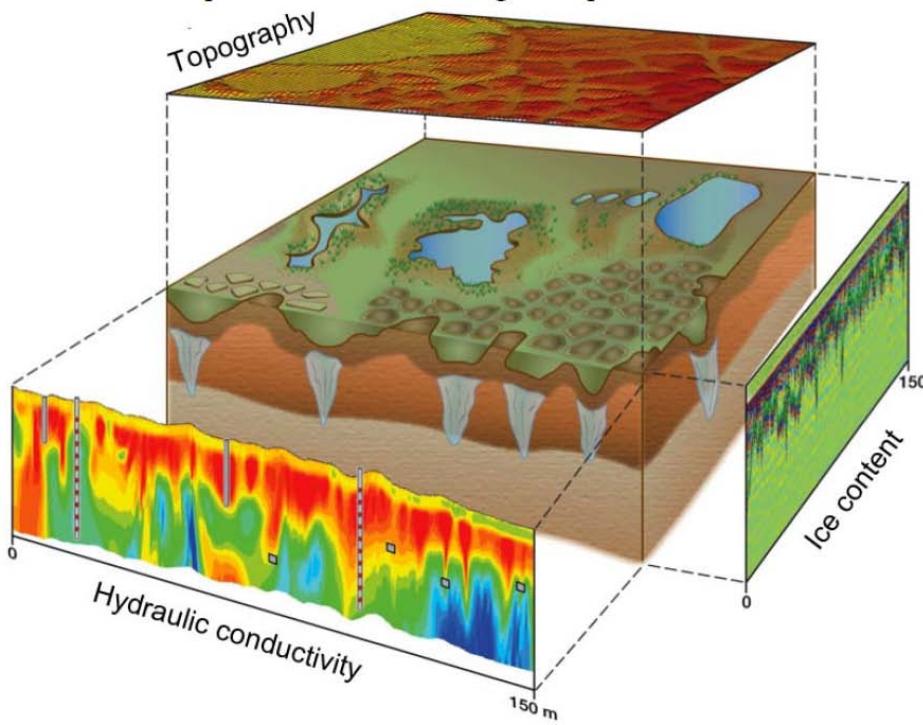


NGEE Permafrost Core Jamboree:

February 24-28, 2014

Cathy Wilson, Heather Throckmorton, Alexander Kholodov, Yuxin Wu, Craig Ulrich, Tim Kneafsey, Catherine McKnight, Shan Dou

Goal: characterize and initialize multi-scale model domains (ground truth geophysics and calibrate CT scan density)



47 cores; 36 for model properties
(Others for metagenomics and incubations)

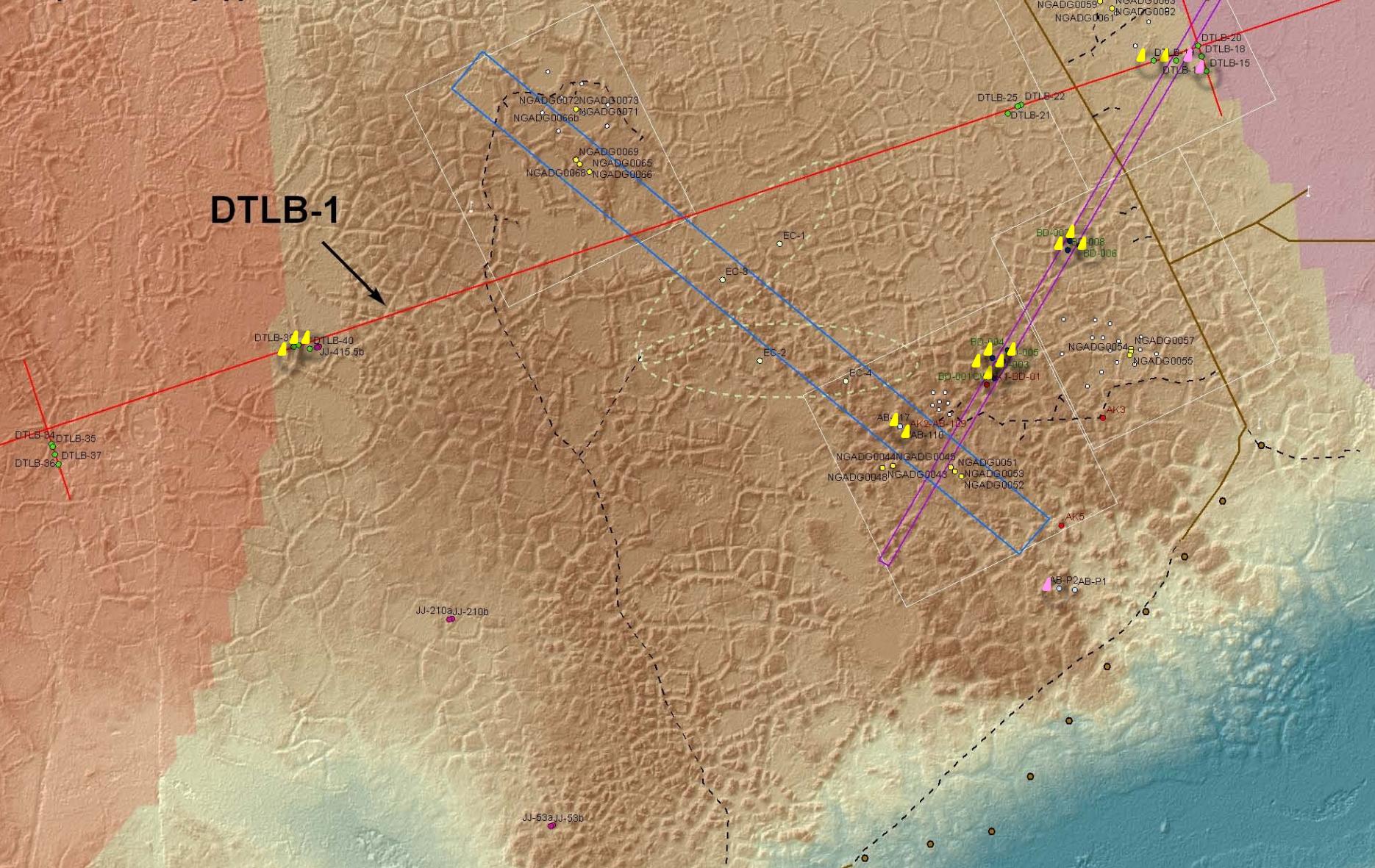
ID	Layer Name	Layer Thick	Layer Vertical Cells	Layer Volume	Min Top Elevation	Max Top Elevation
1	moss(top)	0.02	2 x .01	7.936425	4.50	4.99
2	upper organic	0.18	9 x .02	79.36425	4.48	4.97
3	upper mineral	0.18	9 x .02	71.42801	4.30	4.79
4	lower organic	0.12	6 x .02	47.61855	4.12	4.61
5	lower mineral	0.50	20 x .025	146.44469	4.00	4.49
6	deep mineral	2.2 - 4.8	50 x .09	1745.817	3.50	3.99
7/30	ice	0.00 - 2.3	variable	182.7924	4.49	4.00

Yellow are “priority” cores for processing Feb 2014
Pink is (future) proposed (priority) additions

Old (300-2000)

Medium (50-300 ybp)

DTLB-1



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DTLB-1



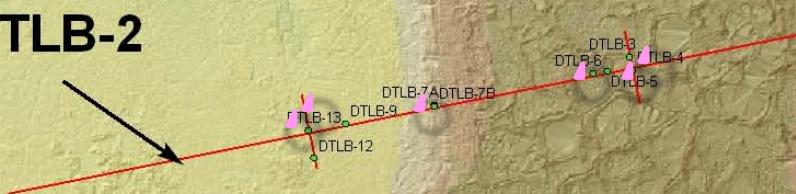
Yellow are “priority” cores for processing
Pink is (future) proposed (priority) additions

NGADG0076 NGADG0077
°NGADG0078

Young (< 50 ybp)

Ancient
(2000-5500 ybp)

DTLB-2



Slice/sample breakdown by analysis type:

- 1A. (while processing) Thermal conductivity (Frozen): 2" probe = 5cm probe
- 1B. LANL: Bulk Density -> Thermal conductivity thawed (5cm minimum); C/N (50g); moisture (50g)
- 1C. Carbon and Nitrogen
7cm minimum slice ; Sample label: PP and CN

- 2. LANL: Water isotopes (20mL water)
10-20g ice wedge or ~50g mineral soil- (aim for 2cm), WI

- 3. LBL: Texture (5g);
aqueous geochemistry (100g)
Minimum = 150g (aim for 5cm), TA

- 4. LBL: a) Permeability (3" slice = 8cm slice);
b) water retention curve (3cm slice)
Minimum 11cm slice if combined (aim for 15cm), PWR

- 5. LANL: Nitrate concentration/N-isotopes; water isotopes
Minimum 10-20mL mL (or gram) of ice = 3-5cm slice, N

Sampling flow-chart

At LBL (step 1) (while processing)

-Horizon delineation (Measure/photograph cores/notes composition).
-Double check sampling protocols/CT scans with horizon compositions, to see if changes need to be made to sampling protocol before slicing.

-Pre-label bags.
-Color test (1 per distinct horizon).

AT LBL (while processing):
5-7cm slice for frozen thermal conductivity.
Note exact length of slice (for bulk density and ice content)
Weigh and note sample frozen (for bulk density and ice content)

Package for ship to LANL

1. LANL: Dry Thermal conductivity
Dry – measure dry weight (Bulk density / ice content)
Grind (dry sample): C/N; ^{14}C ; etc.

1)

**Measure/
slice (1)**

2)

Package for ship to LANL

2). LANL ~2cm slice for water isotopes

5.

Package for ship to LANL

5. LANL: Nitrate

4.

3. LBL: (post-processing)
Texture; aqueous geochemistry (100g)

4. LBL: (post-processing)
Permeability; water retention

IF NOT ENOUGH SAMPLE FOR GEOCHEMISTRY

Package subsample for LBL Texture

LBL: IF NOT ENOUGH SAMPLE PER HORIZON FOR GEOCHEMISTRY

Subsample this piece for texture (~5g dry)

NGEE Arctic “permafrost core jamboree” team



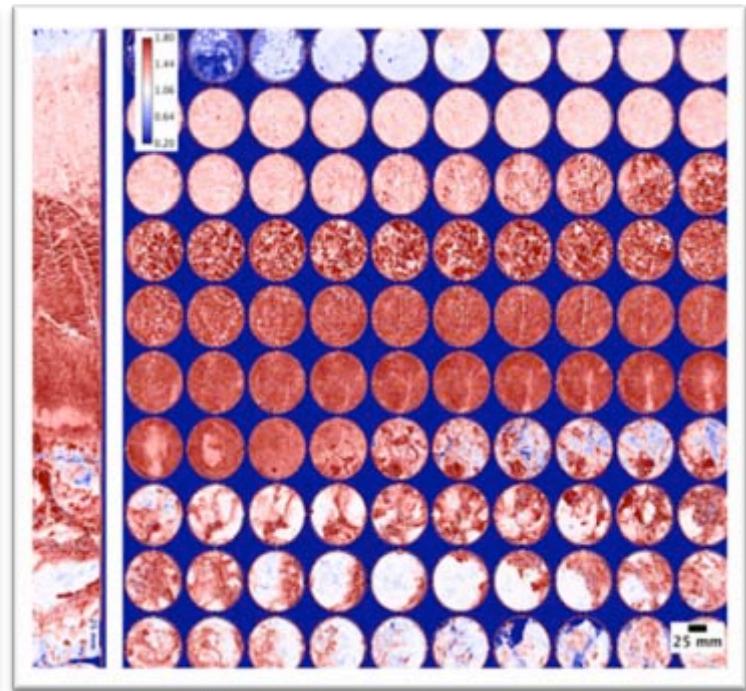
Left to Right: Catherine McKnight (LBNL), Heather Throckmorton (LANL), Alex Kholodov (UAF), Craig Ulrich (LBNL), Cathy Wilson (LANL) and Yuxin Wu (LBNL). Photo credit Roy Kaltschmidt (LBNL).

Collection of permafrost cores (Barrow)



Left to Right: Garrett Altmann (LANL), Andy Chamberlain (UAF), Joel Rowland (LANL) and Alexander Kholodov (UAF). Photo credit Cathy Wilson (LANL).

CT scanning



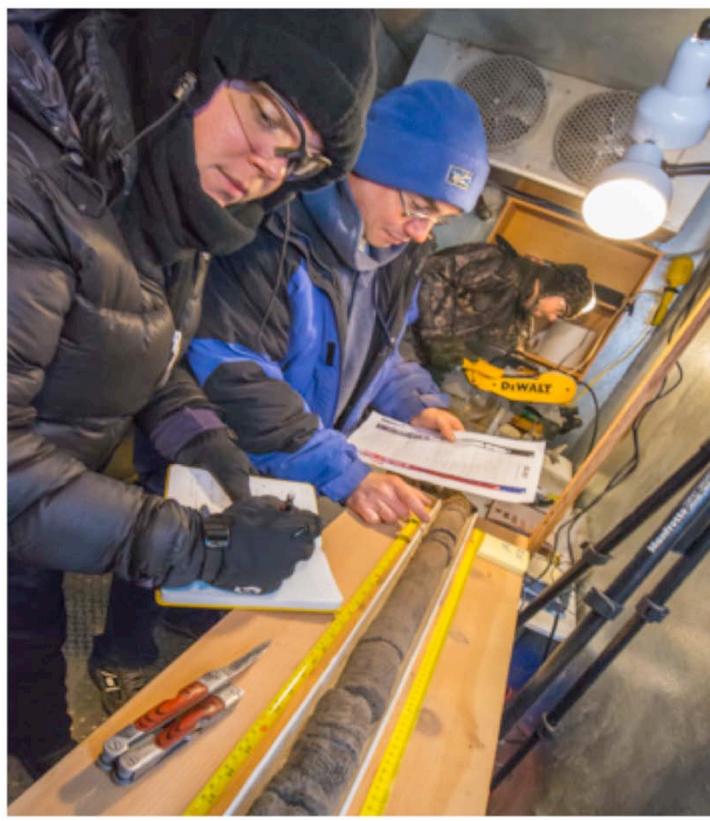
Tim Kneafsey (LBNL) working on NGEE Arctic cores with the CT scanner (Left). CT images from a permafrost core that is ca. one meter in length (Right). Photo credit Roy Kaltschmidt (LBNL).

Core processing



Cathy Wilson (LANL) annotating the CT scan image and labeling sample bags. CT images were annotated with sample analysis information and sample depth intervals in preparation for sub-sampling with the chop saw in the cold lab. Photo credit Roy Kaltschmidt (LBNL).

Core processing



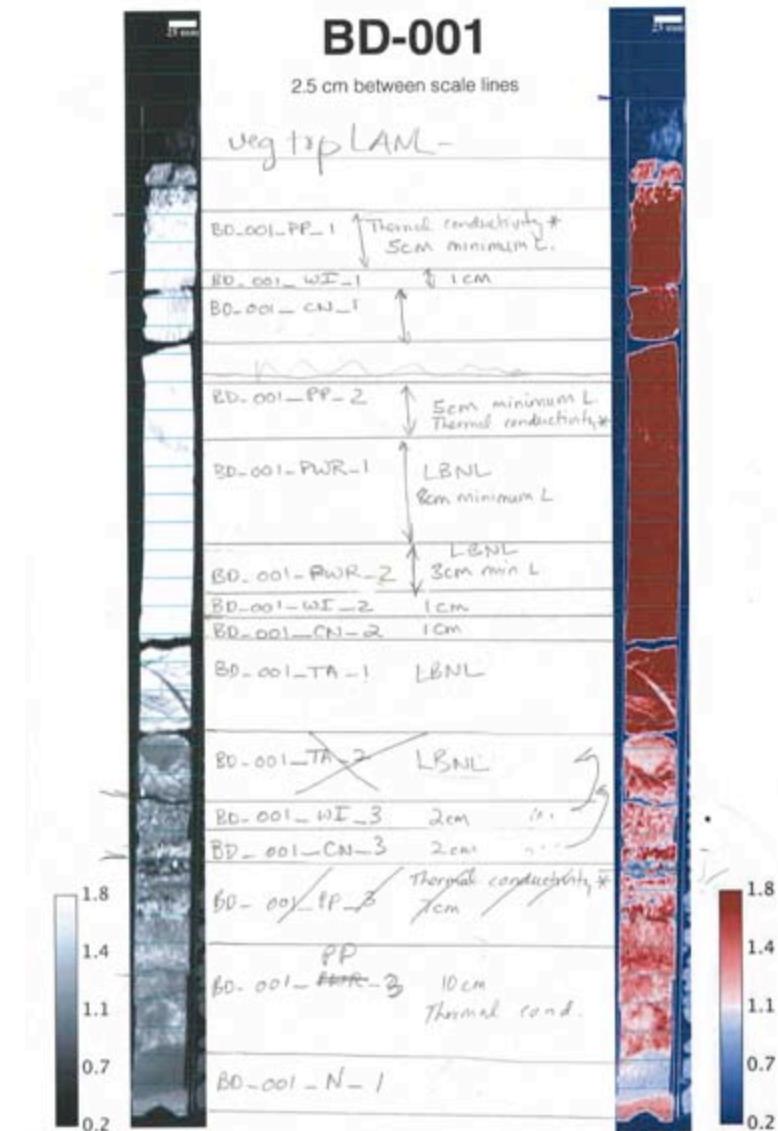
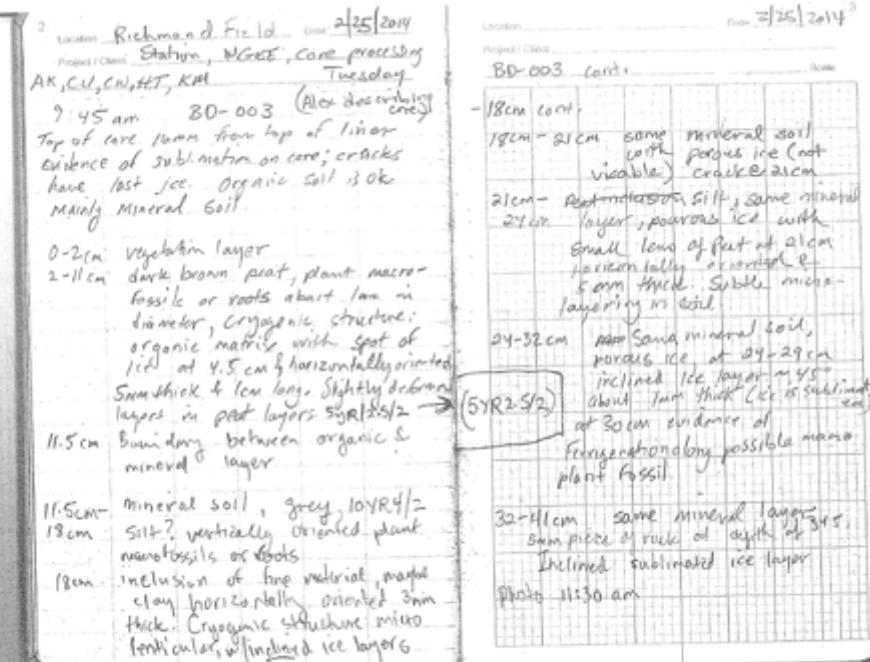
NGEE Arctic researchers working on cores inside the cold lab. Right to left: Craig Ulrich (LBL), Alex Kholodov (UAF), Heather Throckmorton (LANL). Photo credit Roy Kaltschmidt (LBNL).

Core slice sample



Sectioned NGEE Arctic core sample from the center of a transitional polygon showing a brown mineral silty sand appearance with porous cryostructure and an ice inclusion. Photo credit Roy Kaltschmidt (LBNL).

Files: Scanned notes from processing



Scanned notebook with all notes (core descriptions and subsampling info)

Annotated CT scans with sampling info

Files: post-processing

Location: Richmond Field station

2/25/2014

Initials: AK, CU, CW, HT, KM

Alex describing core:

BD-003

Top of core 16mm from top of liner.

Evidence of sublimation on core; cracks have lost ice. Organic soil is OK. Mainly mineral soil.

0-2cm: vegetation layer

2-11cm: dark brown peat, plant macro-fossils or roots about 1mm in diameter. Cryogenic structure: organic matrix with spot of ice at 4.5cm and horizontally oriented. 5mm thick and 1cm long. Slightly deformed layers in peat.

Color: 5yr 2.5/2.

11.5cm: boundary between organic and mineral layer.

11.5 mineral soil, grey, 10yr 4/2.

18cm: silt? Vertically oriented plant macrofossils or roots.

18cm: inclusion of fine material; maybe clay horizontally oriented (3mm thick).

Cryogenic structure: micro-lenticular, with inclined ice layers.

18-21cm: some mineral soils with porous ice content (not visible). Crack at 21 cm.

21-24cm: silt and the same mineral layer as above. Porous ice with small lens of peat at 21cm horizontally oriented and 5mm thick. Subtle micro-layering in soil.

24-32 cm: Same mineral soil, porous ice at 24-29cm. Inclined ice layer ~45degrees, about 1mm thick (ice is sublimated). At 30cm evidence of ferrigenation along possible macro plant fossil.

32-41cm: same mineral layer. 5mm piece of rock at depth of 34.5. Inclined sublimated ice layer.

BD_001

Alex describing core

Top of the core 9mm below top of liner.

0-5cm: vegetation/moss

5-7cm: mineral soil. Gray silt (?). 10yr 6/2.

Lenticular. Ice layer thickness 1-2mm.

7-21.5cm: mineral soil. Gray silt (?). plant microfossils. Roots and grass.

Micro-lenticular. Ice layer thickness <1mm.

21.5-48cm: porous ice (cryo-structure).

Vertical cracks with sublimated (?) ice <1mm thick.

48-57cm (same mineral soil). Reticular. Subvertical ice veins with a thickness <2mm. Horizontal ice veins 1-3mm thick.

Distance between horizontal veins in upper part of horizon about 1cm. Lower part

Note: Sample_ID indicates analyses

WI: Water isotopes (LANL)

PP: Physical properties (Thermal conductivity done on frozen sample while processing; post-processing: bulk de TA: Texture and aqueous geochemistry (LBL)

CN: C and N elemental (bulk) and isotopic analyses (LANL)

N: Nitrate concentration and isotope analyses (N and O)

Core_ID	Sample_ID	Depth (cm)	Weight (g)	Notes
BD_003	BD_003_WI_2	0-4	37.6	
	BD_003_PP_1a	4-12	124.61	
	BD_003_PP_2a	11.5-21	254.18	Organic layer, no thermal Slight overlap Thermal cond.; no C/N
	BD_003_WI_1	21-24	74	
	BD_003_PP_3	24-32	245.8	C/N; no thermal cond.
	BD_003_TA_1	32-41	238.36	Mineral layer
BD_001	BD_001_PP_1	7-14	173.05	Thermal conduct.
	BD_001_WI_1	14-16	50.56	
	BD_001_CN_1	16-21	100.3	
	BD_001_PP_2	21-28	176.3	
	BD_001_PWR_1	28-37	257.7	
	BD_001_PWR_2	37-42	139.8	
	BD_001_WI_2	42-44	57.05	
	BD_001_CN_2	44-47.5	106.8	
	BD_001_TA_1	48-55	188.67	
	BD_001_WI_3	56-59	48.96	
BD_002	BD_002_CN_1	3-5.5	23.18	
	BD_002_WI_1	5.5-7	30.58	
	BD_002_PP_1	8-15	200.17	
	BD_002_WI_2	15-17	49.45	
	BD_002_CN_2	17-19	48.88	
	BD_002_TA_1	19-24	122.89	
	BD_002_TA_2	24-27	67.36	
	BD_002_WI_3	27-29.5	42.38	
	BD_002_CN_3	29.5-32	48.36	
	BD_002_PP_2	32-40	143.02	
BD_002	BD_002_N_1	50-52	N/A	
	BD_002_WI_4	69-72	N/A	
BD_004	BD_004_Moss	0-2	LANL	
	BD_004_WI_1	2-5	22.13	
	BD_004_CN_1	5-8	14.71	
	BD_004_PP_1	8-16	35.52	
	BD_004_WI_2	16-19	19.91	
	BD_004_CN_2	19-21	19.83	
	BD_004_TA_1	21-26	138.97	
	BD_004_PP_2	27-35	152.18	
	BD_004_WI_3	35-37	27.37	
	BD_004_CN_3	37-39	24.25	
	BD_004_N_1	39-41	31.83	

Document with transcribed soil descriptions for all cores (example page above)

Spreadsheet with subsampling info (core ID, depth info, weight, sample type)

Thermal conductivity results

Core ID	Depth interval, cm	ThC1	ThC2	ThC3	ThC average, W/(m*°K)	Std. Deviation	Std. Error	Soil description
BD03	15-21	1.80	1.74	1.87	1.80	0.07	0.04	Mineral soil with microlenticular cryostructure
BD01	7-14		2.50	2.56	2.53	0.04	0.03	Mineral soil with microlenticular cryostructure
	21-28	2.34	2.26	2.16	2.25	0.09	0.05	Mineral soil with porous ice
	77-83	2.09	2.22	2.38	2.23	0.14	0.08	Organic rich mineral soil with microlenticular cryostructure
	8-15	2.72	2.64	2.47	2.61	0.13	0.08	Organic rich mineral soil with porous ice
BD02	32-40	1.56	1.60		1.58	0.03	0.02	Peat with matrix cryostructure
	8-16	0.16	0.17		0.17	0.00	0.00	Fibrous with matrix and porphirous cryostructure
BD04	27-35	1.36	1.44	1.52	1.44	0.08	0.05	Organic rich mineral soil with braided cryostructure
	7-15	1.95	1.93	1.71	1.86	0.13	0.08	Mineral soil with lenticular cryostructure
	21-29	0.89	0.94	0.91	0.91	0.02	0.01	Organic rich mineral soil with porous ice
	39-46	1.51	1.62	1.70	1.61	0.10	0.06	Mineral soil with layered cryostructure