

## **Supporting online material of**

### **Yedoma Ice Complex of the Buor Khaya Peninsula (southern Laptev Sea)**

Lutz Schirrmeister<sup>1</sup>, Georg Schwamborn<sup>1</sup>, Pier Paul Overduin<sup>1</sup>, Jens Strauss<sup>1</sup>, Margret C. Fuchs<sup>2</sup>, Mikhail Grigoriev<sup>3</sup>, Irina Yakshina<sup>4</sup>, Janet Rethemeyer<sup>5</sup>, Elisabeth Dietze<sup>6</sup>, Sebastian Wetterich<sup>1</sup>

<sup>1</sup>Department of Periglacial Research, Alfred Wegener Institute Helmholtz Center for Polar and Marine Research, Potsdam, D-14473, Germany

<sup>2</sup>Helmholtz Institute Freiberg for Resource Technology, Helmholtz-Zentrum Dresden-Rossendorf, Freiberg, D-09599, Germany

<sup>3</sup>Melnikov Permafrost Institute, Siberian Branch of the Russian Academy of Science, Yakutsk, 677010, Russia

<sup>4</sup>Lena Delta Reserve, Tiksi, 678400, Russia

<sup>5</sup>Institute of Geology and Mineralogy, University of Cologne, D-50674, Germany

<sup>6</sup>GFZ German Research Centre for Geosciences, Section 5.2 Climate Dynamics and Landscape Evolution, Potsdam, D-14473, Germany

*Correspondence to:* Lutz Schirrmeister (lutz.schirrmeister@awi.de)

**SOM 1.** Detailed cryolithological description of the BK-8 core.

<b>Depth [m bs]</b>	<b>Height [m asl]</b>	<b>Sediment</b>	<b>Cryostructure</b>
0-0.1	34.0-33.9	dark-brown silty fine sand, plant remains, roots, blades of grass	irregular fine
0.1-0.25	33.9-33.75	silty fine sand, brown spots, plant remains at 0.11-0.15, changeover from brown-grey-brown, plant remains horizontally	0.1-0.15 transverse-diagonal lens-like 0.15-0.25 horizontal fine lens-like
0.25-0.35	33.75-33.65	brown, silty fine sand, roots	from micro to fine to massive ice lenses
0.35-0.45	33.65-33.55	grey-brown silty fine sand, peat inclusions, cryoturbated	ice lenses 1-2 cm long and 1mm thick
0.45-0.55	33.55-33.45	grey-brown silty fine sand	coarse lens-like, 1 -2 cm long and 3 mm thick; sediment blocks 0.5-1 cm thick and 1-2 cm long
0.55-0.85	33.45-33.15	grey silty fine sand, 0.5-2 cm plant remains	coarse lens-like vertical ice lenses, 3-5 cm long and 2-5 mm thick
0.85-1.8	33.15-32.2	grey-brown, silty fine sand, woody plant remains	irregular vertical ice veins, 1-5 mm thick and 10-15 cm long, Polosatik? (fragments of ice wedges)
1.8-2.1	32.2-31.9	grey-brown silty fine sand, plant detritus up to 2 mm thick and 1 cm long,	very irregular ice lenses; mostly ice in lower part of the section because of cutting ice veins
2.1-2.4	31.9-31.6	grey-brown silty fine sand, small plant remains (< 2 mm)	Subvertically-orientated lenses with reticulated structure
2.4-3.00	31.6-31.0	grey-brown silty fine sand, some plant remains <0.5cm	subvertical ice veins <10 cm long <1cm thick, in some sections fine ice lenses alternate with coarse ice lenses
3.00-3.15	31.0-30.85		mostly clear, very coarse lens-like ice-poor sediment inclusions
3.15-3.40	30.85-30.6	few grey-brown silty fine sand	massive ice, in the upper part some air bubbles, in the lower part entrapped air, horizontal ice bands, upper part milky, lower part grey
3.40-7.60	30.6-26.4		clear ice with sediment inclusions and parallel-oriented sediment stripes up to 5 mm thick, gas bubbles <1mm in diameter (no orientation)
7.60-8.35	26.4-25.65		clear ice with distinct 1-2mm wide sediment stripes, orientation of bubbles indicated
8.35-8.75	25.65-25.25	grey-brown silty fine sand, leaf remains <1 cm	ice-wedge contact zone, diagonal coarse lens-like ice lenses 1-3 cm long and 1-5 mm thick
8.75-9.60	25.25-24.4	grey-brown silty fine sand, plant remains <2-5 mm	Vertical-reticulated coarse ice lenses, 2-10 cm long and <1cm thick; sediment blocks 1-2 cm long and 2-5m thick
9.60-9.95	24.4-24.05	grey-brown silty fine sand, yellow-brownish spots, single plant remains	vertical to diagonal coarse lens-like ice lenses, 2-4 mm long and 2-5 mm thick
9.95-10.65	24.05-23.35	grey-brown silty fine sand, brownish spots	fine lens-like reticulated ice lenses 0.5-1 cm long and 1-2 m thick, different orientation from top to bottom
10.30-10.65	23.7-23.35	grey silty fine sand, single plant remains	coarse reticulated ice-rich sediment blocks, ice lenses 2-4 cm long and 2-7 mm thick,

10.65-10.72	23.35-23.28	grey silt	diagonal fine lens-like ice veins 1 mm thick. and long ice veins <5cm long and 2 mm thick
10.72-10.95	23.28-23.05	partly isolated grey-brown sediment, few organics	horizontal, coarse lens-like reticulated ice veins, 1-2 cm long and 1-3 mm thick
10.95-11.10	23.05-22.9	grey silt, few organics	fine lens-like (sub-mm), transition towards coarser lens-like
11.10-11.20	22.9-22.8	grey silt, organic inclusions	lens-like reticulated
11.20-11.40	22.8-22.6	laminated sediment inclusions in 11.40-11.30, brown-yellow spots	fine ice lenses 1-2m thick, 2-5m long
11.40-11.55	22.6-22.45	few organic, yellow- brownish spots	coarse lens-like reticulated
11.55-11.70	22.45-22.3	finely grained (fine sand/silt), plant remains	fine lens-like, coarse lamination ice bands at 11.60
11.70-12.55	22.3-21.45	brown-grey to dark grey, silty fine sand color-darkness increases from top to bottom, numerous plant remains incl. woody roots up to 4 mm	fine lens-like ice lenses (upper 10 cm), followed by vertical ice lenses 10-15 mm long, sub-horizontal single ice bands at 12.20 and at 12.30 at 12.45-12.55 transition from blocky to reticulated ice-rich sub-horizontal
12.55-12.70	21.45-21.3	brownish grey silt	fine lens-like, diagonal <0.5m, transition from ice-rich to less ice-rich sections
12.70-12.80	21.3-21.2	brownish grey silt, few organic remains,	coarse lens-like, reticulated, blocky
12.80-12.95	21.2-21.05	brownish grey silt, , organic remains, non-cut core segment taken from lower part (lower 2 cm) for OSL dating	fine lens-like ice-rich and coarse lens-like ice bands
12.95-13.10	21.05-20.9	grey silt, large plant remains incl. woody roots <0.5 cm,	coarse lens-like horizontal-diagonal ice veins 1-4 cm long
13.10-13.35	20.9-20.65	grey brown silty fine sand, partly big plant remains with ice crusts	upper 2 cm massive ice with single ice veins, followed by fine lens-like ice veins (middle 15 cm), then small lens-like 1-2 mm ice bands (lower 8 cm)
13.35-13.50	20.65-20.5	grey brown silty fine sand, few organics	ice bands, 2 cm thick at the top, followed by coarse lens-like, blocky
13.50-13.60	20.5-20.4	grey brown silty fine sand, few organics	coarse lens-like reticulated (1-2 x 1-2 cm)
13.60-14.15	20.4-19.85	grey brown silty fine sand, few organics	subhorizontal lens-like ice bands, 0.5-2 cm thick
14.15-14.25	19.85-19.75	grey brown silty fine sand, few organics	fine lens-like, horizontal, single subvertical ice veins
14.25-14.50	19.75-19.5	grey brown silty fine sand, few organics	14.25-14.30: lens-like (0.5-1 cm long, <1mm thick), single vertical ice veins, ice bands 14.30-14.40: blocky , ice veins 2-5 cm long 1-2 mm thick, sediment blocks 1-2 mm long 2-5m thick, 14.40-14.50: coarse lens-like isolated ice blocks 0.5-1 cm in diameter
14.50-14.65	19.5-19.35	grey brown silty fine sand, organics < 1cm	blocky, ice veins 2-5 cm long 1-2 m thick, sediment blocks 1-2 x 1-2 cm

14.65-14.95	19.35-19.05	grey brown silty fine sand, woody remains up to 10 mm	irregular fine lens-like subvertical ice veins with ice crusts at the organic remains
14.95-15.35	19.05-18.65	grey brown silty fine sand, organic remains decrease from top to bottom	blocky, with several ice bands at: 14.95m-15.15m, 15.25m-15.30m horizontal ice veins 1-2cm long 1-2 cm thick, vertical ice veins 3-7 cm long 1cm thick
15.35-15.45	18.65-18.55	dark grey, clay rich silt, no organics	15.35-15.38: blocky (see above) 15.38-15.45: massive ice with sediment bands
15.45-15.90	18.55-18.1	grey brown silty fine sand, no organics	15.45-15.54: massive ice with sediment bands 15.54-15.62: blocky, ice veins 1m thick and 1-3 cm long 15.62-15.70: ice-rich with isolated 0.5-1 cm long sediment blocks, ice bands 15.70-15.80: lens to coarse lens-like, increasing downwards 15.80-15.90: massive ice crystals 1-2 cm large
15.90-16.00	18.1-18.0	grey brown silty fine sand, few organics, non-cut core segment	fine lens-like
16.00-16.20	18.0-17.8	grey brown silty fine sand, few organics	horizontal lens to fine lens-like and massive at 16.00, 16.08, and 16.18 m, lower 2 cm coarse lens-like horizontal ice veins
16.25-16.55	17.8-17.45	grey brown silty fine sand, few organics, non-cut core segment for OSL dating	transition from coarse to fine vertical ice veins
16.55-16.70	17.45-17.3	grey brown silty fine sand, few organics	transition from isolated sediment blocks 0.5-1 cm in diameter to horizontal fine lens-like
16.70-16.90	17.3-17.1	grey brown silty fine sand, few organics	transition from coarse to fine to micro lens-like, single organic remains
16.90-17.00	17.1-10.0	grey brown silty fine sand, plant remains horizontally distributed	micro lens-like, relatively ice poor
17.00-17.05	17.0-16.95	grey brown silty fine sand, 1cm frozen drill mud	coarse, reticulated, blocky, ice-rich ice lenses 1-2 cm long and 1-2 mm thick
17.05-17.70	16.95-16.3	grey brown silty fine sand, plant remains distributed	horizontal, micro lens-like
17.70-17.95	16.3-16.05	grey brown silty fine sand, woody remains up to 2 mm	transition from coarse to fine ice lenses, horizontal to diagonal transversal, single organic remains
17.95-18.30	16.05-15.7	grey brown silty fine sand, plant remains < 1 cm long	transition from micro to fine lens-like, single subvertical ice veins 1-3 cm long
18.30-18.40	15.7-15.6	grey-brown silty fine sand, few organics (probably frozen drill mud!)	fine lens-like
18.40-18.50	15.6-15.5	grey brown silty fine sand, single plant remains <1 mm	horizontal fine- to micro lens-like
18.50-18.70	15.5-15.3	grey brown silty fine sand, single plant remains <1 mm	irregular lens-like
18.70-18.90	15.3-15.1	grey brown silty fine sand, single organic remains, non-cut core segment for OSL dating	horizontal, lenses to fine lenses



**SOM 2.** Cryolithological examples of different units of the BK-8 permafrost core (A-C: Active layer and Lateglacial to early Holocene cover, D-E: ice wedge, F-G: Yedoma contact zone, H-J: Yedoma horizontal bedding, K-L: salty Yedoma).

