Table S1. Optically stimulated luminescence ages and supporting data for the subsea permafrost drill core 4D-12. All samples were measured with preheat 220°C and cut heat at 200°C. The Central Age Model (Galbraith et al., 1999) was used to calculate the dose. Samples Lund-12063 and Lund-12065 were rejected due to very poor dose recovery ratios.

Lab no.	Sample no.	Depth	Age	Dose	n	Dose rate	Water	Stimulation[a]	Dose recovery ratio	Note
		m	ka	Gy	acc./total	Gy ka^{-1}	%			
Lund-12059	IVD-2012-1	15	8.52 ± 0.59	25.8 ± 1.3	21/24	3.02 ± 0.15	40	Blue	0.97 ± 0.02	b
Lund-12060	IVD-2012-2	17	50.8 ± 5.0	128 ± 11	18/24	2.52 ± 0.13	36	Pulsed	1.03 ± 0.07	c
Lund-12061	IVD-2012-3	24	70.4 ± 6.2	226 ± 16	15/19	3.21 ± 0.17	20	Post-IR blue	1.00 ± 0.14	d
Lund-12062	IVD-2012-4	28	75.2 ± 5.5	233 ± 13	20/21	3.09 ± 0.15	17	Post-IR blue	0.90 ± 0.17	b
Lund-12063	IVD-2012-5	35	Rejected			2.90 ± 0.12	16	Post-IR blue	0.62 ± 0.09	
Lund-12064	IVD-2012-6	42	141 ± 19	331 ± 40	16/21	2.34 ± 0.13	22	Pulsed	0.96 ± 0.16	c
Lund-12065	IVD-2012-7	47	Rejected			2.28 ± 0.10	26	Pulsed	1.38 ± 0.17	
Lund-12066	IVD-2012-8	51	162 ± 22	257 ± 31	16/30	1.59 ± 0.11	29	Post-IR blue	0.94 ± 0.12	e

[a]Stimulation by blue light (Murray and Wintle, 2000, 2003), post-infrared blue light (Banerjee et al., 2001), and pulsed OSL (Ankjærgaard et al., 2010).
[b]Signal integration limits 0-0.8 s, background 0.8-1.6 s.
[c]Signal integration limits 0-2 s, background 2-4 s.
[d]Signal integration limits 0-1.6 s, background 36-40 s.
[e]Signal integration limits 0-1.6 s, background 1.6-3.2 s.

Table S2. Grain size distribution of the subsea permafrost drill cores 4D-13, 2D-13, and 4D-12 from the Buor Khaya Bay. Peaks of grain size distribution were determined using Gradistat v8 (Blott and Pye, 2001).

Core	Depth	> 10 mm	5-10 mm	2-5 mm	1-2 mm	0.5-1 mm	250-500 µm	100-250 µm	50-100 µm	10-50 µm	5-10 µm	1-5 µm	< 1 µm	Grain size distribution peaks
	m	%	%	%	%	%	%	%	%	%	%	%	%	
4D-13	0.20-0.40	0.00	0.00	0.00	0.00	10.58	31.54	16.29	3.56	15.27	7.94	12.15	2.67	375 µm, 7.5 µm
4D-13	7.00-7.20	0.00	0.00	0.00	0.00	2.76	10.80	15.64	15.30	34.09	7.39	11.18	2.84	75 µm
4D-13	8.00-8.20	0.00	0.00	0.00	0.00	3.31	13.32	15.48	12.28	32.67	7.51	12.32	3.11	30 µm, 375 µm
4D-13	9.20-9.40	0.00	0.00	0.00	0.00	11.65	29.44	13.72	7.74	21.49	4.99	8.70	2.27	375 µm, 30 µm
4D-13	9.80-10.00	0.00	0.00	0.00	0.00	3.95	21.81	20.82	11.68	23.52	6.44	9.29	2.49	375 µm
4D-13	11.20-11.40	0.00	0.00	0.00	0.00	9.76	27.90	17.24	3.78	14.99	8.03	14.26	4.04	375 µm, 7.5 µm
4D-13	13.60-13.80	0.00	0.00	0.00	0.00	2.46	21.16	37.73	11.80	13.02	4.35	7.67	1.81	175 µm
4D-13	15.20-15.40	0.00	0.00	0.00	0.00	13.43	35.60	13.59	7.92	16.40	4.21	7.17	1.68	375 µm
4D-13	16.20-16.40	0.00	0.00	0.00	0.00	9.14	31.14	21.46	5.93	11.96	5.86	11.18	3.33	375 µm, 7.5 µm
4D-13	17.00-17.20	0.00	0.00	0.00	0.00	5.28	27.39	23.38	8.65	14.06	6.39	11.60	3.25	375 µm, 7.5 µm
4D-13	17.40-17.60	0.00	0.00	0.00	0.00	8.08	24.11	17.57	6.65	18.76	7.47	13.30	4.06	375 µm, 30 µm
4D-13	18.00-18.20	0.00	0.00	0.00	0.00	1.33	5.81	6.09	8.46	44.91	11.99	17.28	4.13	30 µm, 375 µm
4D-13	18.30-18.50	0.00	0.00	0.00	0.00	0.00	0.00	0.84	4.53	47.70	15.64	24.84	6.45	30 µm
4D-13	18.60-19.00	0.00	0.00	0.00	0.00	0.29	0.83	2.30	4.62	49.99	16.52	21.04	4.41	30 µm
4D-13	20.40-20.60	0.00	0.00	0.00	0.00	11.94	34.01	13.24	2.62	10.76	7.65	15.22	4.56	375 µm, 7.5 µm
2D-13	0.30-0.70	0.00	0.00	0.00	0.00	0.78	8.94	60.01	18.12	6.10	1.57	3.35	1.13	175 µm
2D-13	1.30-1.40	0.00	0.00	0.00	0.00	0.48	9.56	61.56	17.11	5.38	1.54	3.30	1.07	175 µm
2D-13	1.50-1.60	0.00	0.00	0.00	0.00	0.76	7.12	55.38	25.59	5.01	1.49	3.49	1.16	175 µm
2D-13	7.20-7.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.12	36.92	21.42	33.94	7.60	7.5 µm
2D-13	7.60-7.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09	36.91	20.95	33.60	8.45	7.5 µm
2D-13	8.00-8.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.18	40.58	19.52	31.48	8.24	7.5 µm
2D-13	8.40-8.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	21.08	27.11	40.90	10.91	7.5 µm
2D-13	8.70-8.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.13	37.43	20.48	33.19	8.77	7.5 µm
2D-13	9.50-9.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	31.99	21.12	37.37	9.47	7.5 µm
2D-13	11.00-11.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	30.49	21.21	38.16	10.14	7.5 µm
2D-13	12.30-12.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	33.57	21.28	36.14	8.96	7.5 µm
2D-13	13.00-13.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.13	33.65	21.04	36.28	8.90	7.5 µm
2D-13	13.90-14.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	35.09	20.93	35.03	8.95	7.5 µm
2D-13	15.10-15.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.14	35.54	21.39	35.21	7.72	7.5 µm
2D-13	15.40-15.50	0.00	0.00	0.00	0.00	8.75	29.50	26.66	12.62	11.97	2.86	5.80	1.84	375 µm
2D-13	15.70-15.80	0.00	0.00	0.00	0.00	9.05	27.90	22.20	12.16	13.49	4.23	8.45	2.52	375 µm
2D-13	15.90-16.00	0.00	0.00	0.00	0.00	5.85	23.40	26.41	17.38	14.84	3.07	6.91	2.14	375 µm
2D-13	16.80-17.00	0.00	0.00	0.00	0.00	3.98	15.81	26.50	17.89	17.81	5.48	9.78	2.75	175 µm
2D-13	17.60-17.80	0.00	0.00	0.00	0.00	16.09	41.88	15.00	5.64	7.99	3.66	7.58	2.16	375 µm
2D-13	18.00-18.20	0.00	0.00	0.00	0.00	0.00	5.87	17.46	15.91	33.81	10.53	13.42	3.00	75 µm

2D-13	18.40-18.60	0.00	0.00	0.00	0.00	0.19	1.75	9.01	13.51	42.55	12.42	15.58	4.99	30 µm
2D-13	19.20-19.40	0.00	0.00	0.00	0.00	7.90	18.87	15.53	12.98	26.87	6.15	9.09	2.61	375 µm, 75 µm
2D-13	20.00-20.20	0.00	0.00	0.00	0.00	0.00	12.60	32.24	18.32	20.21	5.38	8.82	2.43	175 µm
2D-13	20.30-20.50	0.00	0.00	0.00	0.00	1.10	2.29	5.39	9.43	47.56	13.56	15.92	4.75	30 µm
2D-13	20.80-21.00	0.00	0.00	0.00	0.00	1.13	6.50	3.23	5.04	50.95	10.59	17.67	4.89	30 µm, 375 µm
2D-13	21.80-22.00	0.00	0.00	0.00	0.00	0.00	0.00	0.60	6.79	58.97	10.61	18.04	4.99	30 µm
2D-13	22.20-22.40	0.00	0.00	0.00	0.00	1.18	4.67	1.95	5.44	52.55	10.38	18.40	5.43	30 µm, 375 µm
2D-13	22.70-22.90	0.00	0.00	0.00	0.00	3.64	8.93	1.57	3.60	51.13	9.49	16.79	4.85	30 µm, 375 µm
2D-13	23.00-23.20	0.00	0.00	0.00	0.00	1.58	5.22	1.48	5.01	54.17	9.66	17.65	5.23	30 µm, 375 µm
2D-13	24.00-24.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.91	69.04	9.44	15.53	4.08	30 µm
2D-13	24.50-24.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.13	68.99	9.13	15.18	4.57	30 µm
2D-13	25.00-25.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.64	69.99	8.49	14.59	4.29	30 µm
2D-13	25.50-25.70	0.00	0.00	0.00	0.00	0.00	0.00	0.01	3.89	72.03	6.50	13.49	4.08	30 µm
2D-13	28.30-28.50	0.00	0.00	0.00	0.00	7.57	20.32	28.88	21.87	10.46	2.72	6.27	1.91	75 µm
2D-13	29.00-29.00	0.00	0.00	0.00	0.00	5.19	16.63	32.30	24.46	9.11	2.64	7.31	2.36	75 µm
2D-13	29.40-29.60	0.00	0.00	0.00	0.00	0.00	0.00	0.11	4.42	59.48	10.67	19.62	5.70	30 µm
2D-13	29.60-29.80	0.00	0.00	0.00	0.00	0.00	0.00	0.40	4.26	59.49	11.02	19.45	5.38	30 µm
2D-13	30.00-30.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.27	60.11	10.61	19.43	5.58	30 µm
4D-12	0.00-0.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.52	27.11	59.38	10.99	7.5 µm
4D-12	1.00-1.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	35.76	24.78	33.72	5.74	7.5 µm
4D-12	3.00-3.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	23.01	28.63	41.40	6.96	7.5 µm
4D-12	3.45-3.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	26.80	26.39	39.38	7.43	7.5 µm
4D-12	3.65-3.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.30	30.30	54.23	10.17	7.5 µm
4D-12	4.00-4.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.52	47.81	15.94	25.61	7.12	30 µm
4D-12	4.15-4.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	31.23	26.38	35.93	6.46	7.5 µm
4D-12	5.20-5.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.46	59.18	14.29	19.78	5.29	30 µm
4D-12	6.00-6.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.53	55.66	15.09	20.31	6.41	30 µm
4D-12	6.45-6.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	33.81	23.10	33.94	9.15	7.5 µm
4D-12	6.90-6.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	34.55	20.75	35.39	9.31	7.5 µm
4D-12	7.30-7.35	0.00	0.00	1.56	2.87	4.55	14.54	24.36	3.11	6.27	15.36	22.55	4.84	175 µm, 7.5 µm
4D-12	12.00-12.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15.97	23.90	48.46	11.67	7.5 µm
4D-12	14.00-14.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9.11	31.25	50.68	8.96	7.5 µm
4D-12	16.00-16.10	0.00	0.00	1.68	8.52	24.77	33.32	28.05	2.54	1.12	0.00	0.00	0.00	375 µm
4D-12	16.40-16.50	0.00	0.00	0.14	0.77	1.93	6.65	82.85	7.27	0.39	0.00	0.00	0.00	175 µm
4D-12	19.00-19.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	11.11	23.98	51.54	13.37	7.5 µm
4D-12	19.50-19.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	14.78	24.13	49.23	11.86	7.5 µm
4D-12	20.40-20.45	0.00	0.00	0.00	0.00	0.00	0.00	0.05	13.02	48.25	8.96	22.40	7.32	30 µm, 3 µm
4D-12	20.55-20.60	0.00	0.00	2.26	17.13	23.90	34.80	16.73	4.25	0.93	0.00	0.00	0.00	375 µm
4D-12	20.90-20.95	0.00	0.00	0.00	12.20	12.26	10.66	52.23	11.95	0.70	0.00	0.00	0.00	175 µm, 750 µm
4D-12	22.40-22.45	0.00	0.00	1.95	10.77	8.15	11.54	44.92	21.54	1.13	0.00	0.00	0.00	175 µm, 1.5 mm

4D-12	23.45-23.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	20.70	25.68	44.50	9.12	7.5 µm
4D-12	24.05-24.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	44.47	19.51	28.76	7.26	7.5 µm
4D-12	24.50-24.55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.92	53.57	14.96	23.10	5.45	30 µm
4D-12	25.00-25.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	19.96	25.52	41.10	13.42	7.5 µm
4D-12	26.00-26.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	41.74	20.74	30.34	7.18	7.5 µm
4D-12	26.10-26.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.20	62.36	12.11	18.37	4.96	30 µm
4D-12	26.20-26.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.20	43.41	18.23	30.12	8.04	30 µm
4D-12	27.10-27.20	0.00	0.00	4.06	12.88	14.42	14.69	44.06	8.31	1.58	0.00	0.00	0.00	175 µm
4D-12	28.80-28.90	0.00	0.00	2.07	8.11	11.18	9.90	38.47	0.33	4.49	7.70	14.04	3.71	175 µm, 750 µm, 7.5 µm
4D-12	29.00-29.10	0.00	0.00	1.93	6.79	15.88	12.11	16.60	0.35	23.11	9.39	11.37	2.47	750 µm, 175 µm, 30 µm
4D-12	30.00-30.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.17	47.92	18.45	27.31	6.15	30 µm
4D-12	31.00-31.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.93	23.02	49.95	16.10	7.5 µm
4D-12	31.40-31.45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	27.79	28.83	35.48	7.90	7.5 µm
4D-12	31.50-31.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.32	63.09	12.94	18.17	5.48	30 µm
4D-12	32.10-32.15	0.00	0.00	0.00	0.00	0.24	2.04	5.50	4.54	41.33	16.96	22.94	6.45	30 µm
4D-12	32.20-32.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.18	46.72	18.28	28.26	6.56	30 µm
4D-12	33.50-33.55	0.00	0.00	3.30	8.25	6.97	15.14	20.26	5.10	10.56	10.22	16.16	4.04	175 µm, 7.5 µm, 1.5 mm
4D-12	33.58-33.62	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	30.69	25.89	36.96	6.46	7.5 µm
4D-12	36.50-36.60	0.00	0.00	9.39	14.09	10.06	27.55	26.75	0.40	1.32	3.14	5.99	1.32	375 µm, 1.5 mm
4D-12	38.50-38.60	0.00	0.00	0.43	1.90	5.90	27.66	59.11	4.50	0.50	0.00	0.00	0.00	175 µm
4D-12	39.50-39.60	0.00	0.00	0.06	1.46	5.88	17.78	68.10	6.38	0.34	0.00	0.00	0.00	175 µm
4D-12	40.50-40.60	0.00	0.00	0.00	0.16	4.61	56.50	36.46	1.99	0.28	0.00	0.00	0.00	375 µm
4D-12	41.00-41.10	0.00	0.00	0.06	0.39	5.53	30.88	55.26	6.91	0.97	0.00	0.00	0.00	175 µm
4D-12	41.80-41.90	0.00	0.00	0.00	0.37	3.22	23.56	52.36	0.67	5.16	4.52	8.21	1.93	175 µm
4D-12	43.10-43.20	0.00	0.00	0.00	0.21	3.46	30.69	63.59	1.90	0.15	0.00	0.00	0.00	175 µm
4D-12	44.10-44.15	0.00	0.00	0.00	0.29	0.77	17.72	77.85	3.06	0.31	0.00	0.00	0.00	175 µm
4D-12	44.60-44.65	0.00	0.00	0.00	0.24	1.49	25.55	69.68	2.77	0.27	0.00	0.00	0.00	175 µm
4D-12	45.00-45.10	0.00	0.00	0.96	3.56	6.36	3.97	80.05	4.93	0.17	0.00	0.00	0.00	175 µm
4D-12	46.50-46.55	0.00	0.00	0.00	0.00	1.38	19.22	76.37	2.76	0.28	0.00	0.00	0.00	175 µm
4D-12	47.00-47.10	0.00	0.00	0.00	0.31	2.43	4.07	84.68	0.45	2.73	1.68	2.98	0.67	175 µm
4D-12	47.50-47.60	0.00	0.00	0.00	0.21	1.52	21.38	69.65	6.62	0.62	0.00	0.00	0.00	175 µm
4D-12	48.00-48.10	0.00	0.00	0.00	0.48	2.48	9.00	68.00	18.68	1.37	0.00	0.00	0.00	175 µm
4D-12	49.00-49.10	0.00	0.00	0.00	0.28	0.65	2.42	85.48	10.60	0.57	0.00	0.00	0.00	175 µm
4D-12	49.50-49.55	0.00	0.00	0.00	0.22	0.31	0.44	67.80	29.71	1.53	0.00	0.00	0.00	175 µm
4D-12	49.60-49.70	0.00	0.00	0.00	0.52	3.81	27.05	59.39	8.53	0.70	0.00	0.00	0.00	175 µm
4D-12	50.00-50.10	0.00	0.00	0.29	0.24	0.29	1.83	43.77	1.00	1.30	10.37	31.61	9.30	175 µm, 3 µm
4D-12	51.00-51.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	17.91	22.83	47.16	12.10	7.5 µm
4D-12	54.00-54.10	0.00	0.00	0.00	0.14	0.35	1.04	71.87	25.70	0.90	0.00	0.00	0.00	175 µm

Table S3. Organic C (OC) and total N (TN) content, gravimetric OC/TN ratios, $\delta^{13}C$ values of organic carbon, and specific surface area (SSA) for 3 m increments at the thaw front of the subsea permafrost drill cores 4D-13, 2D-13, and 4D-12 from the Buor Khaya Bay.

Core	Depth	OC	TN	OC/TN	$\delta^{13}C$	SSA
	m	% dry weight	% dry weight		‰	$m^2 g^{-1}$ dry weight
4D-13	7.00	0.63	0.08	7.60	-22.96	7.40
4D-13	7.05	0.65	0.08	8.10	-22.81	
4D-13	7.10	0.66	0.09	7.41	-22.73	
4D-13	7.15	0.67	0.09	7.64	-23.30	
4D-13	7.20	0.64	0.08	7.89	-23.34	
4D-13	7.25	0.66	0.08	8.06	-23.08	
4D-13	7.30	0.62	0.08	7.98	-23.48	
4D-13	7.35	0.69	0.09	7.79	-22.95	
4D-13	7.40	0.62	0.08	7.61	-22.80	6.07
4D-13	7.45	0.65	0.08	7.95	-23.13	
4D-13	7.50	0.66	0.08	7.94	-22.77	
4D-13	7.55	0.63	0.08	8.29	-22.71	
4D-13	7.60	0.66	0.09	7.74	-23.23	
4D-13	7.65	0.65	0.08	7.76	-23.01	
4D-13	7.70	0.68	0.08	8.61	-23.45	
4D-13	7.75	0.62	0.08	7.72	-25.88	
4D-13	7.80	0.68	0.10	7.05	-23.00	8.78
4D-13	7.85	0.70	0.08	8.47	-24.90	11.50
4D-13	7.90	0.85	0.07	12.92	-25.38	13.90
4D-13	7.95	0.84	0.07	12.35	-25.33	
4D-13	8.00	0.88	0.07	12.07	-25.26	
4D-13	8.05	0.69	0.06	11.42	-25.08	
4D-13	8.10	0.88	0.08	11.17	-24.80	
4D-13	8.15	0.74	0.07	11.05	-25.82	12.05
4D-13	8.20	0.91	0.08	11.52	-25.88	
4D-13	8.25	0.53	0.04	13.07	-25.11	
4D-13	8.30	0.82	0.07	12.23	-24.91	
4D-13	8.35	0.49	0.05	10.37	-23.92	
4D-13	8.40	0.73	0.05	13.62	-25.62	
4D-13	8.45	0.56	0.05	11.67	-24.13	5.48
4D-13	8.50	0.43	0.04	9.90	-23.41	
4D-13	8.55	0.52	0.06	9.15	-23.23	
4D-13	8.60	0.41	0.04	10.29	-23.27	
4D-13	8.65	0.79	0.07	11.04	-25.59	
4D-13	8.70	0.69	0.06	11.41	-25.19	12.95
4D-13	8.75	0.93	0.08	11.86	-25.19	12.83
4D-13	8.80	0.80	0.07	11.45	-25.17	12.06
4D-13	8.85	1.33	0.10	13.65	-25.72	13.16
4D-13	8.90	0.64	0.05	11.85	-25.29	10.92
4D-13	8.95	0.85	0.07	11.51	-25.10	8.26
4D-13	9.00	0.55	0.05	10.75	-23.61	4.89
4D-13	9.05	0.49	0.05	10.24	-23.37	3.92
4D-13	9.10	0.39	0.04	11.04	-23.56	3.30
4D-13	9.15	0.44	0.04	10.14	-23.56	
4D-13	9.20	0.45	0.04	10.67	-23.28	
4D-13	9.25	0.49	0.04	11.08	-23.38	
4D-13	9.30	0.45	0.04	10.86	-22.88	3.91
4D-13	9.35	0.50	0.05	10.14	-23.61	
4D-13	9.40	0.42	0.04	11.20	-23.28	
4D-13	9.45	0.48	0.05	9.56	-23.73	3.21
4D-13	9.50	0.38	0.04	10.41	-23.31	3.95

4D-13	9.55	2.62	0.24	10.80	-26.66	11.41
4D-13	9.60	0.93	0.10	9.18	-25.01	9.97
4D-13	9.65	0.91	0.10	9.19	-25.15	9.21
4D-13	9.70	1.62	0.16	10.06	-26.71	
4D-13	9.75	0.90	0.11	8.56	-25.01	
4D-13	9.80	0.93	0.10	9.51	-24.90	
4D-13	9.85	0.87	0.11	7.99	-23.57	8.91
4D-13	9.90	1.20	0.12	9.90	-24.94	
4D-13	9.95	0.83	0.10	8.53	-24.39	
4D-13	10.00	0.46	0.05	10.28	-24.92	9.16
2D-13	14.10	0.75	0.05	15.14	-24.96	
2D-13	14.25	0.80	0.05	15.96	-24.35	4.76
2D-13	14.35	0.56	0.04	14.41	-24.35	
2D-13	14.45	0.61	0.04	14.47	-24.69	
2D-13	14.55	0.69	0.05	14.54	-24.52	
2D-13	14.70	0.37	0.04	10.17	-24.23	4.63
2D-13	14.80	0.94	0.05	19.35	-25.27	
2D-13	14.90	1.07	0.07	16.44	-25.97	
2D-13	15.00	0.73	0.06	12.76	-25.00	
2D-13	15.10	0.84	0.07	11.39	-25.40	13.75
2D-13	15.20	0.87	0.09	9.85	-26.11	
2D-13	15.30	0.80	0.08	9.82	-25.92	
2D-13	15.35	0.77	0.08	10.05	-25.59	15.16
2D-13	15.40	0.70	0.06	12.26	-25.12	
2D-13	15.45	0.80	0.06	13.23	-25.49	
2D-13	15.50	0.93	0.06	16.18	-24.94	8.32
2D-13	15.55	0.70	0.06	12.07	-25.21	
2D-13	15.60	0.73	0.05	13.79	-25.08	
2D-13	15.65	0.73	0.05	13.58	-25.19	9.62
2D-13	15.70	0.56	0.07	8.33	-25.38	15.47
2D-13	15.75	0.48	0.06	8.10	-24.99	13.76
2D-13	15.80	0.63	0.07	9.44	-25.68	16.46
2D-13	15.85	0.54	0.06	8.34	-24.93	15.07
2D-13	15.90	0.59	0.06	9.17	-25.12	13.04
2D-13	16.00	0.61	0.06	9.59	-25.35	14.21
2D-13	16.20	0.64	0.06	10.43	-24.84	14.04
2D-13	16.40	0.66	0.06	10.74	-24.90	13.21
2D-13	16.60	0.61	0.06	9.66	-25.32	
2D-13	16.70	0.68	0.06	10.66	-24.96	13.69
2D-13	16.80	0.67	0.06	10.78	-25.07	
2D-13	16.90	0.77	0.07	11.03	-24.70	13.56
4D-12	22.00	0.63	0.10	6.59	-25.58	18.49
4D-12	22.05	0.67	0.10	6.86	-25.76	
4D-12	22.10	0.64	0.10	6.47	-25.64	
4D-12	22.15	0.64	0.10	6.60	-25.42	
4D-12	22.20	0.62	0.10	6.25	-25.39	
4D-12	22.25	0.67	0.10	6.51	-24.84	
4D-12	22.30	0.75	0.10	7.34	-25.47	
4D-12	22.35	0.87	0.11	7.93	-25.49	
4D-12	22.40	0.81	0.11	7.42	-25.75	20.55
4D-12	22.45	0.75	0.11	6.87	-25.58	
4D-12	22.50	0.69	0.10	6.96	-25.39	
4D-12	22.55	0.75	0.11	6.90	-25.46	
4D-12	22.60	0.86	0.11	7.50	-25.38	
4D-12	22.65	0.84	0.12	7.17	-25.48	
4D-12	22.70	0.83	0.11	7.42	-25.72	

4D-12	22.75	0.82	0.11	7.18	-25.67	
4D-12	22.80	0.66	0.10	6.88	-25.71	19.83
4D-12	22.85	0.72	0.10	7.23	-25.87	
4D-12	22.90	0.72	0.10	7.34	-25.53	
4D-12	22.95	0.70	0.10	6.79	-25.68	
4D-12	23.00	0.72	0.10	7.13	-25.64	
4D-12	23.05	0.69	0.10	6.79	-25.50	
4D-12	23.10	0.66	0.09	7.18	-25.51	
4D-12	23.15	0.67	0.09	7.19	-25.29	
4D-12	23.20	0.69	0.10	6.99	-25.47	22.23
4D-12	23.25	0.70	0.09	7.50	-25.60	
4D-12	23.30	0.66	0.09	7.11	-25.60	
4D-12	23.35	0.68	0.09	7.27	-25.74	
4D-12	23.40	0.78	0.10	8.04	-25.83	
4D-12	23.45	0.66	0.10	6.83	-25.50	
4D-12	23.50	0.70	0.10	7.20	-25.39	
4D-12	23.55	0.77	0.10	7.37	-25.34	
4D-12	23.60	0.83	0.10	8.07	-25.41	
4D-12	23.65	0.64	0.09	7.01	-25.44	19.31
4D-12	23.70	0.68	0.09	7.24	-25.48	19.83
4D-12	23.75	0.73	0.10	7.18	-25.02	21.29
4D-12	23.80	0.89	0.10	8.86	-26.25	17.29
4D-12	23.85	0.72	0.10	7.48	-25.43	22.18
4D-12	23.90	0.90	0.11	8.29	-26.48	19.77
4D-12	23.95	0.84	0.10	8.32	-26.12	19.02
4D-12	24.00	0.94	0.10	9.28	-26.82	17.31
4D-12	24.05	0.79	0.11	7.26	-25.80	21.19
4D-12	24.10	0.76	0.10	7.53	-25.52	21.03
4D-12	24.15	0.74	0.10	7.41	-25.15	
4D-12	24.20	0.73	0.10	7.29	-25.43	
4D-12	24.25	0.77	0.10	7.65	-25.34	
4D-12	24.30	0.71	0.09	7.53	-25.69	
4D-12	24.35	0.79	0.10	7.61	-25.72	
4D-12	24.40	0.77	0.10	7.48	-25.54	
4D-12	24.45	0.82	0.11	7.56	-25.88	
4D-12	24.50	0.81	0.11	7.58	-25.42	
4D-12	24.55	0.91	0.12	7.33	-25.39	22.08
4D-12	24.60	0.87	0.12	7.15	-25.70	
4D-12	24.65	0.78	0.11	7.04	-25.66	
4D-12	24.70	0.77	0.11	6.89	-25.30	
4D-12	24.75	0.84	0.11	7.42	-25.37	
4D-12	24.80	0.81	0.11	7.26	-25.27	
4D-12	24.85	0.64	0.10	6.58	-25.31	
4D-12	24.90	0.74	0.10	7.17	-25.41	
4D-12	24.95	0.71	0.10	7.09	-25.45	
4D-12	25.00	0.83	0.10	7.91	-24.97	20.59

Table S4. Concentrations of vanillin (Vl), acetovanillone (Vn), vanillic acid (Vd), syringaldehyde (Sl), acetosyringone (Sn), syringic acid (Sd), p-coumaric acid (pCd), ferulic acid (Fd), benzoic acid (Bd), m-hydroxybenzoic acid (m-Bd), 3,5-dihydroxybenzoic acid (3,5-Bd), p-hydroxybenzaldehyde (Pl), p-hydroxyacetophenone (Pn), and p-hydroxybenzoic acid) for 3 m increments at the thaw front of the subsea permafrost drill cores 4D-13, 2D-13, 4D-12 from the Buor Khaya Bay.

Core	Depth	Vl	Vn	Vd	Sl	Sn	Sd	pCd	Fd	Bd	m-Bd	3,5-Bd	Pl	Pn	Pd
	m							mg g^{-1} OC							
4D-13	7.00	0.21	0.05	0.22	0.10	0.02	0.06	0.02	0.02	0.11	0.04	0.17	0.16	0.04	0.28
4D-13	7.40	0.13	0.05	0.15	0.08	0.04	0.07	0.04	0.04	0.10	0.07	0.05	0.17	0.07	0.22
4D-13	7.80	3.65	0.84	1.47	3.20	0.84	0.89	0.78	1.66	0.38	0.19	0.54	1.37	0.29	2.49
4D-13	7.85	5.05	1.22	2.30	3.95	1.03	1.22	0.78	1.51	0.64	0.23	0.45	1.55	0.32	3.15
4D-13	7.90	2.14	0.46	0.95	1.48	0.39	0.47	0.50	0.86	0.27	0.13	0.14	0.73	0.13	2.09
4D-13	8.15	4.04	0.88	1.44	2.74	0.67	0.69	0.43	0.72	0.48	0.24	0.56	1.26	0.29	2.58
4D-13	8.45	3.17	0.58	1.14	1.53	0.34	0.38	0.14	0.24	0.61	0.10	0.26	0.71	0.15	1.02
4D-13	8.70	2.30	0.40	0.98	1.43	0.31	0.46	0.37	0.66	0.25	0.11	0.13	0.77	0.13	2.34
4D-13	8.75	4.64	1.13	1.82	3.34	0.86	0.94	0.54	1.07	0.43	0.20	0.55	1.19	0.26	2.44
4D-13	8.80	4.91	1.17	1.91	3.36	0.89	0.90	0.52	0.98	0.42	0.22	0.48	1.31	0.29	2.84
4D-13	8.85	1.63	0.36	0.72	0.95	0.26	0.33	0.35	0.58	0.30	0.11	0.13	0.60	0.13	2.10
4D-13	8.90	8.05	1.93	2.93	5.40	1.40	1.38	0.78	1.71	0.60	0.31	0.94	2.07	0.49	4.36
4D-13	8.95	2.99	0.58	1.21	1.97	0.57	0.69	0.43	0.74	0.41	0.16	0.38	1.00	0.18	1.68
4D-13	9.00	0.63	0.17	0.36	0.26	0.10	0.18	0.12	0.14	0.19	0.14	0.11	0.42	0.14	0.68
4D-13	9.05	0.43	0.09	0.23	0.19	0.04	0.08	0.03	0.04	0.06	0.05	0.14	0.16	0.04	0.28
4D-13	9.10	0.24	0.12	0.20	0.14	0.09	0.12	0.08	0.09	0.19	0.16	0.18	0.25	0.13	0.27
4D-13	9.30	0.17	0.03	0.10	0.08	0.01	0.03	0.02	0.03	0.04	0.02	0.00	0.15	0.02	0.24
4D-13	9.45	0.15	0.03	0.08	0.09	0.03	0.03	0.01	0.02	0.27	0.03	0.09	0.06	0.03	0.08
4D-13	9.50	0.63	0.13	0.30	0.32	0.07	0.10	0.05	0.07	0.14	0.07	0.16	0.32	0.08	0.47
4D-13	9.55	1.42	0.33	0.83	1.35	0.48	0.64	1.21	2.82	0.12	0.09	0.15	1.47	0.17	3.10
4D-13	9.60	3.87	0.94	1.60	4.85	1.30	1.31	1.29	4.42	0.38	0.18	0.56	2.47	0.49	3.71
4D-13	9.65	4.00	0.99	1.36	4.05	1.08	0.99	0.85	2.53	0.40	0.17	0.59	1.98	0.41	2.90
4D-13	9.85	0.71	0.11	0.31	0.50	0.09	0.19	0.24	0.49	0.06	0.04	0.04	0.48	0.06	0.90
4D-13	10.00	3.62	0.84	1.75	2.50	0.62	0.91	0.56	0.93	0.57	0.17	0.42	1.51	0.26	2.65
2D-13	14.25	0.67	0.10	0.24	0.30	0.04	0.06	0.06	0.09	0.07	0.03	0.05	0.47	0.07	0.63
2D-13	14.70	0.55	0.05	0.20	0.22	0.01	0.07	0.03	0.04	0.02	0.03	0.02	0.35	0.05	0.51
2D-13	15.10	0.62	0.13	0.32	0.42	0.09	0.10	0.11	0.12	0.15	0.05	0.08	0.37	0.07	0.73
2D-13	15.35	0.71	0.14	0.31	0.45	0.09	0.10	0.11	0.10	0.12	0.05	0.07	0.31	0.07	0.75
2D-13	15.50	0.43	0.08	0.22	0.18	0.03	0.04	0.06	0.10	0.08	0.04	0.07	0.18	0.04	0.43
2D-13	15.65	0.73	0.10	0.42	0.27	0.05	0.07	0.08	0.11	0.02	0.04	0.07	0.24	0.04	1.20
2D-13	15.70	1.15	0.20	0.48	0.70	0.17	0.17	0.18	0.21	0.29	0.05	0.07	0.42	0.07	0.71
2D-13	15.75	0.87	0.10	0.34	0.41	0.06	0.12	0.10	0.11	0.09	0.03	0.02	0.44	0.05	0.44
2D-13	15.80	0.91	0.18	0.36	0.58	0.16	0.15	0.17	0.28	0.15	0.05	0.07	0.38	0.06	0.45
2D-13	15.85	0.92	0.14	0.40	0.52	0.09	0.15	0.12	0.13	0.07	0.05	0.06	0.41	0.06	0.48
2D-13	15.90	0.92	0.19	0.40	0.56	0.13	0.15	0.16	0.21	0.13	0.04	0.07	0.35	0.06	0.40
2D-13	16.00	0.89	0.15	0.37	0.50	0.13	0.13	0.15	0.23	0.09	0.04	0.07	0.27	0.06	0.62
2D-13	16.20	0.95	0.18	0.40	0.60	0.15	0.15	0.18	0.23	0.17	0.05	0.08	0.27	0.05	0.80
2D-13	16.40	1.10	0.19	0.44	0.67	0.15	0.16	0.18	0.32	0.08	0.06	0.11	0.35	0.07	0.81
2D-13	16.70	1.12	0.22	0.41	0.56	0.13	0.14	0.11	0.22	0.16	0.05	0.07	0.31	0.07	0.48
2D-13	16.90	0.59	0.10	0.24	0.31	0.06	0.08	0.09	0.11	0.02	0.04	0.06	0.28	0.04	0.34
4D-12	22.00	0.82	0.27	0.46	0.57	0.22	0.24	0.24	0.42	0.14	0.14	0.15	0.43	0.14	0.50
4D-12	22.40	1.29	0.25	0.55	1.24	0.38	0.30	0.42	0.97	0.05	0.08	0.12	0.67	0.12	0.58
4D-12	22.80	1.01	0.26	0.52	0.75	0.28	0.29	0.30	0.64	0.11	0.07	0.09	0.47	0.10	0.61
4D-12	23.20	1.52	0.37	0.71	1.18	0.34	0.33	0.23	0.65	0.27	0.23	0.18	0.56	0.12	0.98
4D-12	23.65	0.86	0.21	0.38	0.51	0.14	0.14	0.16	0.27	0.19	0.33	0.05	0.39	0.07	0.87
4D-12	23.70	1.00	0.23	0.50	0.67	0.20	0.20	0.22	0.51	0.20	0.50	0.15	0.43	0.10	1.41
4D-12	23.75	0.88	0.16	0.40	0.68	0.16	0.16	0.19	0.33	0.25	0.26	0.04	0.46	0.07	0.77
4D-12	23.80	2.36	0.57	1.12	0.95	0.25	0.26	0.36	2.43	0.16	0.32	0.26	0.49	0.17	0.87

4D-12	23.85	0.98	0.18	0.41	0.71	0.16	0.17	0.18	0.39	0.14	0.12	0.07	0.50	0.07	0.52
4D-12	23.90	0.79	0.25	0.49	0.34	0.18	0.22	0.26	0.90	0.20	0.19	0.16	0.34	0.15	0.58
4D-12	23.95	2.21	0.55	1.08	0.43	0.13	0.16	0.22	0.94	0.14	0.11	0.13	0.36	0.10	0.60
4D-12	24.00	1.16	0.23	0.72	0.25	0.06	0.10	0.20	1.41	0.04	0.08	0.06	0.23	0.06	0.57
4D-12	24.05	1.08	0.20	0.49	0.85	0.21	0.23	0.23	0.57	0.07	0.06	0.08	0.48	0.08	0.48
4D-12	24.10	0.53	0.04	0.21	0.27	0.05	0.07	0.09	0.13	0.04	0.04	0.02	0.37	0.04	0.49
4D-12	24.55	0.71	0.12	0.37	0.58	0.15	0.20	0.19	0.42	0.07	0.05	0.06	0.40	0.07	0.43
4D-12	25.00	2.24	0.54	1.00	1.88	0.54	0.56	0.40	0.73	0.27	0.17	0.38	0.93	0.21	0.88

Table S5. Statistical analysis of organic carbon (OC) and total nitrogen (TN) content, OC/TN ratios, $\delta^{13}C$ values of organic carbon, lignin concentrations, as well as S/V, C/V, Sd/Sl, Vd/Vl, and 3,5-Bd/V ratios, measured in 3 m increments at the thaw front of the subsea permafrost drill cores 4D-13, 2D-13, and 4D-12. "Correlation" columns show Spearman's correlation coefficient and level of significance derived from Spearman's rank sum correlations between individual parameters and depth above the IBPT; positive correlations reflect an increase in the respective parameter with distance above the IBPT. "Difference" columns show the effect direction and level of significance derived from t-tests between core increments above and below the IBPT; positive signs indicate higher values above than below the IBPT. ***, $p < 0.001$; **, $p < 0.01$; *, $p < 0.05$; n.s., not significant.

	4D-13		2D-13		4D-12	
	Correlation	Difference	Correlation	Difference	Correlation	Difference
OC (% dry weight)	n.s.	n.s.	n.s.	n.s.	n.s.	– **
TN (% dry weight)	+0.63 ***	n.s.	–0.53 **	n.s.	n.s.	– **
OC/TN	–0.74 ***	n.s.	+0.67 ***	+ **	–0.53 ***	– *
$\delta^{13}C$ (‰)	+0.65 ***	n.s.	n.s.	n.s.	n.s.	n.s.
SSA ($m^2\ g^{-1}$ dry weight)	n.s.	+ **	n.s.	n.s.	n.s.	n.s.
OC (mg m^{-2} SSA)	n.s.	– ***	+0.76 **	n.s.	n.s.	– *
Lignin (µg g^{-1} dry weight)	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Lignin (mg g^{-1} OC)	n.s.	n.s.	-0.74 *	n.s.	n.s.	n.s.
S/V	n.s.	n.s.	n.s.	n.s.	+0.68 *	n.s.
C/V	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Sd/Sl	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Vd/Vl	+0.59 *	n.s.	n.s.	n.s.	n.s.	n.s.
3,5-Bd/V	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.