Supplement of Biogeosciences, 15, 1969–1985, 2018
https://doi.org/10.5194/bg-15-1969-2018-supplement

Biogeosciences Open Access EGU

Supplement of

Substrate potential of last interglacial to Holocene permafrost organic matter for future microbial greenhouse gas production

Janina G. Stapel et al.

Correspondence to: Kai Mangelsdorf (k.mangelsdorf@gfz-potsdam.de)

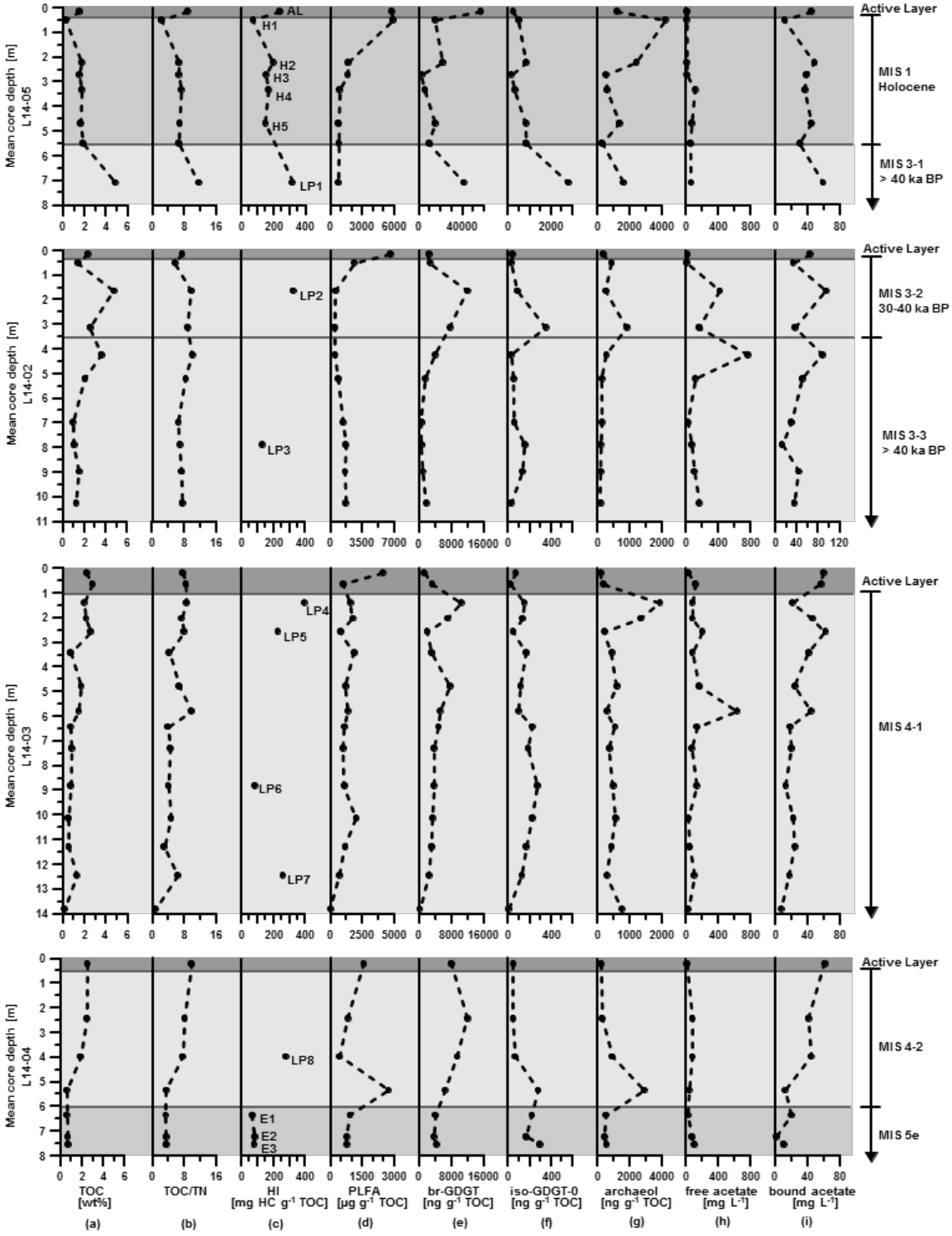
Mean core depth [m]
L14-05
AL
H1
H2
H3
H4
H5
LP1
Active Layer
MIS 1
Holocene
MIS 3-1
> 40 ka BP
Mean core depth [m]
L14-02
LP2
LP3
Active Layer
MIS 3-2
30-40 ka BP
MIS 3-3
> 40 ka BP
Mean core depth [m]
L14-03
LP4
LP5
LP6
LP7
Active Layer
MIS 4-1
Mean core depth [m]
L14-04
LP8
E1
E2
E3
Active Layer
MIS 4-2
MIS 5e
TOC [wt%] (a)
TOC/TN (b)
HI [mg HC g-1 TOC] (c)
PLFA [µg g-1 TOC] (d)
br-GDGT [ng g-1 TOC] (e)
iso-GDGT-0 [ng g-1 TOC] (f)
archaeol [ng g-1 TOC] (g)
free acetate [mg L-1] (h)
bound acetate [mg L-1] (i)

Figure S1: Bio- and geochemical parameters of permafrost cores L14-05, L14-02, L14-03, and L14-04 from Bol´shoy Lyakhovsky Island, northern Siberia, presented with respect to core depth (left axis) as well as stratigraphic and age units (right column). The vertical profiles show (note partly different x-axes) a) the total organic carbon (TOC) content in wt%, b) the ratio of TOC and total nitrogen (TN), c) the hydrogen index (HI) in mg HC g^{-1} of TOC, d) the concentration of phospholipid fatty acids (PLFAs) in µg g^{-1} of TOC, e) the concentration of branched glycerol dialkyl glycerol tetraethers (brGDGTs), f) of isoGDGT-0, and g) of archaeol, all in ng g^{-1} of TOC, and h) the concentration of free acetate and i) bound acetate, both in mg L^{-1}. Active layer samples are shown in dark grey, interglacial periods (MIS 1 and MIS 5e) in grey, and the last glacial period (MIS 3 and MIS 4) in light grey. According to age, stratigraphy, and core segments, the MIS 3 unit is subdivided into the core segments MIS 3-1, 3-2, and 3-3 and the MIS 4 unit into the segments MIS 4-1 and 4-2. Sample labels within the HI profile correspond to core samples of different ages (H: Holocene; LP: Late Pleistocene glacial period; E: Eemian).

Table S1: Concentration of archaeol (Arch.), isoprenoid glycerol dialkyl glycerol tetraethers (GDGT-0, GDGT-1, GDGT-2, crenarchaeol (Crenarch.)), branched GDGTs (GDGT-Ia, GDGT-Ib, GDGT-II, GDGT-III) in ng g^{-1} of sediment and phospholipid fatty acids (PLFAs) in µg g^{-1} of sediment in core samples from Bol'shoy Lyakhovsky Island. Additionally, the branched isoprenoid tetraether (BIT) Index (Hopmans et al., 2004) is noted. For GDGT structures please refer to Schouten et al. (2013).

Core name	Depth	Arch.	isoprenoid GDGTs			Crenarch.	branched GDGTs				PLFA	BIT Index
			0	1	2		Ia	Ib	II	III		
	[m]	ng/g sediment									µg/gSed	
L14-05	0.1	17.7	3.1	0.6	0.6	0.0	125.7	8.2	391.0	309.2	84.2	1.0
	0.5	8.9	1.0	0.2	0.1	0.0	2.6	0.5	11.5	15.2	12.3	1.0
	2.2	41.1	13.9	2.9	2.2	5.1	39.5	5.9	124.0	180.2	27.0	1.0
	2.7	7.5	2.1	0.3	0.2	0.5	2.2	0.5	7.5	10.1	23.0	1.0
	3.3	10.0	4.7	0.7	0.5	1.5	9.2	1.4	29.5	38.8	14.2	1.0
	4.7	22.0	12.6	2.5	2.7	5.2	21.7	4.0	77.8	121.7	11.7	1.0
	5.5	5.4	15.0	3.1	3.5	6.5	20.1	3.6	68.2	68.6	13.7	1.0
	7.1	81.1	133.4	5.5	4.6	0.0	269.5	11.0	871.8	918.1	32.7	1.0
L14-02	0.2	3.9	0.8	0.0	0.0	0.5	12.9	0.5	24.2	15.4	149.3	1.0
	0.5	5.9	0.3	0.0	0.0	0.1	8.2	1.3	16.2	8.5	35.6	1.0
	1.6	12.4	3.8	1.1	0.8	1.0	92.1	14.4	278.8	206.0	23.7	1.0
	3.1	23.2	8.6	1.7	1.5	2.3	26.2	4.3	70.5	90.8	11.2	1.0
	4.2	10.2	0.9	0.5	0.7	1.4	17.1	3.1	68.2	59.3	16.5	1.0
	5.2	2.7	0.9	0.3	0.3	0.8	4.2	1.0	14.6	12.2	16.7	0.9
	7.0	1.4	0.5	0.2	0.2	0.4	0.8	0.1	1.6	1.2	13.0	0.9
	7.9	1.1	1.5	0.4	0.4	1.0	0.9	0.1	2.0	1.7	16.7	0.9
	9	1.5	1.9	0.5	0.5	0.3	2.6	0.3	5.3	5.4	23.0	0.9
	10.2	1.0	0.3	0.0	0.0	0.3	4.6	0.2	9.3	6.8	20.4	1.0
L14-03	0.2	2.0	1.4	0.6	0.6	1.8	4.0	0.4	12.1	10.6	86.3	0.9
	0.6	4.6	0.4	0.0	0.0	0.1	18.5	0.7	42.1	26.0	27.1	1.0
	1.4	38.3	2.8	0.6	0.5	0.0	19.9	1.4	83.7	103.1	30.5	1.0
	2.0	28.8	2.8	0.6	0.6	0.2	21.6	1.2	60.5	65.7	35.8	1.0
	2.6	5.6	1.0	0.3	0.4	0.6	11.0	0.6	24.6	12.1	20.3	1.0
	3.4	3.0	1.1	0.3	0.0	0.4	3.9	0.3	8.7	7.5	12.4	1.0
	4.8	10.1	1.8	0.5	0.3	0.4	21.0	2.0	55.4	49.6	19.4	1.0
	5.8	4.2	1.3	0.4	0.0	0.6	10.3	1.3	29.4	33.1	19.5	1.0
	6.4	3.5	1.4	0.3	0.3	0.5	6.7	0.6	13.3	9.6	7.0	1.0
	7.3	2.8	1.3	0.3	0.3	0.6	5.9	0.5	11.8	8.9	7.4	1.0
	8.8	3.3	1.9	0.5	0.5	1.1	5.4	0.5	10.9	8.5	7.4	1.0
	10.1	2.6	1.0	0.2	0.2	0.4	2.8	0.3	6.2	5.1	9.0	1.0
	11.3	2.0	0.8	0.2	0.2	0.3	3.0	0.2	5.9	4.6	5.3	1.0
	12.4	3.7	1.5	0.0	0.0	0.5	7.4	0.0	12.6	8.1	8.9	1.0
	13.8	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
L14-04	0.2	5.2	1.0	0.4	0.3	0.6	34.5	1.0	82.5	78.9	37.9	1.0
	2.4	7.0	1.0	0.4	0.3	0.1	55.6	3.9	133.7	100.8	19.2	1.0
	4.0	17.4	1.2	0.4	0.4	0.2	29.0	2.2	76.5	67.3	8.0	1.0
	5.3	15.8	1.5	0.2	0.2	0.4	2.8	0.5	9.8	21.1	14.5	1.0
	6.3	2.9	1.2	0.3	0.3	0.6	3.8	0.4	8.3	10.0	5.1	1.0
	7.2	2.5	1.0	0.2	0.2	0.4	3.9	0.4	8.4	9.1	4.6	1.0
	7.5	3.4	1.9	0.5	0.5	1.0	5.6	0.5	10.9	10.2	4.7	1.0

65

Table S2: Concentration of archaeol (Arch.), isoprenoid glycerol dialkyl glycerol tetraethers (GDGT-0, GDGT-1, GDGT-2, crenarchaeol (Crenarch.)), branched GDGTs (GDGT-Ia, GDGT-Ib, GDGT-II, GDGT-III) in ng g^{-1} of TOC and phospholipid fatty acids (PLFAs) in µg g^{-1} of TOC in core samples from Bol'shoy Lyakhovsky Island. For GDGT structures please refer
70 to Schouten et al. (2013). TOC = total organic carbon.

Core name	Depth	TOC	Arch.	isoprenoid GDGTs			Crenarch.	branched GDGTs				PLFA
				0	1	2		Ia	Ib	II	III	
	[m]	[%]	ng/g TOC									µg/gTOC
L14-05	0.1	1.49	1187.9	208.1	40.3	40.3	0.0	8436.2	550.3	26241.6	20751.7	5649.1
	0.5	0.21	4238.1	476.2	95.2	47.6	0.0	1238.1	238.1	5476.2	7238.1	5846.8
	2.2	1.68	2446.4	827.4	172.6	131.0	303.6	2351.2	351.2	7381.0	10726.2	1609.7
	2.7	1.45	517.2	144.8	20.7	13.8	34.5	151.7	34.5	517.2	696.6	1587.2
	3.3	1.7	588.2	276.5	41.2	29.4	88.2	541.2	82.4	1735.3	2282.4	832.5
	4.7	1.59	1383.6	792.5	157.2	169.8	327.0	1364.8	251.6	4893.1	7654.1	735.5
	5.5	1.81	298.3	828.7	171.3	193.4	359.1	1110.5	198.9	3768.0	3790.1	758.4
	7.1	4.79	1693.1	2785.0	114.8	96.0	0.0	5626.3	229.6	18200.4	19167.0	683.4
L14-02	0.2	2.31	168.8	34.6	0.0	0.0	21.6	558.4	21.6	1047.6	666.7	6464.0
	0.5	1.35	437.0	22.2	0.0	0.0	7.4	607.4	96.3	1200.0	629.6	2638.5
	1.6	4.71	263.3	80.7	23.4	17.0	21.2	1955.4	305.7	5919.3	4373.7	504.2
	3.1	2.5	928.0	344.0	68.0	60.0	92.0	1048.0	172.0	2820.0	3632.0	446.4
	4.2	3.59	284.1	25.1	13.9	19.5	39.0	476.3	86.4	1899.7	1651.8	459.0
	5.2	2.02	133.7	44.6	14.9	14.9	39.6	207.9	49.5	722.8	604.0	825.7
	7.0	0.95	147.4	52.6	21.1	21.1	42.1	84.2	10.5	168.4	126.3	1365.6
	7.9	0.99	111.1	151.5	40.4	40.4	101.0	90.9	10.1	202.0	171.7	1685.3
	9	1.48	101.4	128.4	33.8	33.8	20.3	175.7	20.3	358.1	364.9	1553.8
	10.2	1.21	82.6	24.8	0.0	0.0	24.8	380.2	16.5	768.6	562.0	1686.4
L14-03	0.2	2.13	93.9	65.7	28.2	28.2	84.5	187.8	18.8	568.1	497.7	4053.4
	0.6	2.72	169.1	14.7	0.0	0.0	3.7	680.1	25.7	1547.8	955.9	997.3
	1.4	1.94	1974.2	144.3	30.9	25.8	0.0	1025.8	72.2	4314.4	5314.4	1569.6
	2.0	2.1	1371.4	133.3	28.6	28.6	9.5	1028.6	57.1	2881.0	3128.6	1706.4
	2.6	2.57	217.9	38.9	11.7	15.6	23.3	428.0	23.3	957.2	470.8	791.8
	3.4	0.68	441.2	161.8	44.1	0.0	58.8	573.5	44.1	1279.4	1102.9	1824.9
	4.8	1.65	612.1	109.1	30.3	18.2	24.2	1272.7	121.2	3357.6	3006.1	1177.4
	5.8	1.41	297.9	92.2	28.4	0.0	42.6	730.5	92.2	2085.1	2347.5	1384.7
	6.4	0.64	546.9	218.8	46.9	46.9	78.1	1046.9	93.8	2078.1	1500.0	1099.8
	7.3	0.74	378.4	175.7	40.5	40.5	81.1	797.3	67.6	1594.6	1202.7	997.5
	8.8	0.69	478.3	275.4	72.5	72.5	159.4	782.6	72.5	1579.7	1231.9	1074.7
	10.1	0.45	577.8	222.2	44.4	44.4	88.9	622.2	66.7	1377.8	1133.3	2003.1
	11.3	0.47	425.5	170.2	42.6	42.6	63.8	638.3	42.6	1255.3	978.7	1126.9
	12.4	1.24	298.4	121.0	0.0	0.0	40.3	596.8	0.0	1016.1	653.2	717.5
	13.8	0.08	750.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
L14-04	0.2	2.45	212.2	40.8	16.3	12.2	24.5	1408.2	40.8	3367.3	3220.4	1546.2
	2.4	2.41	290.5	41.5	16.6	12.4	4.1	2307.1	161.8	5547.7	4182.6	798.6
	4.0	1.84	945.7	65.2	21.7	21.7	10.9	1576.1	119.6	4157.6	3657.6	436.2
	5.3	0.54	2925.9	277.8	37.0	37.0	74.1	518.5	92.6	1814.8	3907.4	2694.3
	6.3	0.57	508.8	210.5	52.6	52.6	105.3	666.7	70.2	1456.1	1754.4	894.0
	7.2	0.62	403.2	161.3	32.3	32.3	64.5	629.0	64.5	1354.8	1467.7	738.5
	7.5	0.64	531.3	296.9	78.1	78.1	156.3	875.0	78.1	1703.1	1593.8	740.5