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Supplementary Material

Redistribution of soil organic matter by permafrost disturbance in the Canadian High Arctic

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Table S1

Solvent extractable biomarker concentrations and biomarker proxies from the Upper Goose (UG) soil profile at Cape Bounty Arctic Watershed Observatory.

Sample Depth	0 cm (mg/g OC)	5 cm (mg/g OC)	15 cm (mg/g OC)	30 cm (mg/g OC)	40 cm (mg/g OC)	65 cm (mg/g OC)
<i>n</i> -alkanes						
Long-chain Total	0.289 ± 0.008	0.430 ± 0.014	0.439 ± 0.034	0.310 ± 0.016	0.283 ± 0.009	0.062 ± 0.006
Short-chain Total	nd	nd	nd	nd	nd	nd
ACL ₁₉₋₃₃ ^a	26.2 ± 0.1	26.7 ± 0.1	26.9 ± 0.1	26.7 ± 0.1	26.6 ± 0.1	26.2 ± 0.6
CPI ₂₁₋₃₃ ^b	4.51 ± 0.31	6.10 ± 0.48	7.10 ± 0.75	5.38 ± 0.48	5.12 ± 0.38	2.48 ± 0.44
<i>n</i> -alkanols						
Long-chain Total	1.722 ± 0.082	1.760 ± 0.164	2.030 ± 0.228	1.068 ± 0.096	0.915 ± 0.062	0.061 ± 0.006
Short-chain Total	0.008 ± 0.001	0.010 ± 0.003	0.017 ± 0.003	0.011 ± 0.004	0.011 ± 0.004	0.0053 ± 0.0004
ACL ₁₆₋₃₀ ^a	25.3 ± 0.1	25.0 ± 0.1	24.8 ± 0.1	24.7 ± 0.1	24.7 ± 0.1	23.6 ± 0.4
CPI ₂₀₋₃₀ ^b	14.1 ± 2.1	8.83 ± 1.48	11.2 ± 1.9	11.6 ± 1.7	11.6 ± 1.2	4.16 ± 0.66
<i>n</i> -alkanoic acids						
Long-chain Total	1.387 ± 0.052	1.554 ± 0.079	1.828 ± 0.183	0.443 ± 0.031	0.330 ± 0.013	0.042 ± 0.004
Short-chain Total	0.390 ± 0.050	0.414 ± 0.070	0.394 ± 0.045	0.322 ± 0.074	0.170 ± 0.032	0.158 ± 0.018
ACL ₁₄₋₂₈ ^a	22.7 ± 0.4	22.7 ± 0.4	22.8 ± 0.5	21.1 ± 0.8	21.6 ± 0.3	18.4 ± 0.1
CPI ₂₀₋₂₈ ^b	4.19 ± 0.22	4.53 ± 0.39	5.06 ± 0.87	4.71 ± 0.55	4.63 ± 0.35	3.48 ± 0.58
Steroids						
Sterols ^c	1.357 ± 0.082	1.522 ± 0.143	2.187 ± 0.342	1.617 ± 0.216	1.414 ± 0.172	0.038 ± 0.005
Sterones ^d	0.318 ± 0.014	0.534 ± 0.042	0.568 ± 0.069	0.294 ± 0.031	0.264 ± 0.018	nd
Cholesterol	0.067 ± 0.002	0.069 ± 0.014	0.061 ± 0.004	0.054 ± 0.003	0.044 ± 0.003	nd
Ergosterol	0.063 ± 0.020	0.063 ± 0.024	0.053 ± 0.008	0.038 ± 0.010	0.039 ± 0.008	nd
Sugars						
Glucose	0.595 ± 0.058	0.114 ± 0.026	0.048 ± 0.007	0.0167 ± 0.0002	0.011 ± 0.003	0.004 ± 0.002
Mannose	0.583 ± 0.093	0.122 ± 0.028	0.044 ± 0.005	0.016 ± 0.001	0.011 ± 0.002	0.004 ± 0.001
Sucrose	0.791 ± 0.183	0.557 ± 0.134	0.060 ± 0.010	0.050 ± 0.008	0.008 ± 0.002	0.005 ± 0.002
Trehalose	1.500 ± 0.153	2.257 ± 0.201	1.550 ± 0.150	0.289 ± 0.019	0.194 ± 0.010	0.007 ± 0.002

^a ACL_{i-n}, average chain length, = $\Sigma(iX_i + \dots + nX_n) / \Sigma(X_i + \dots + X_n)$, where X is concentration, i is the minimum carbon chain length, and n is the maximum carbon chain length.

^b CPI_{i-n}, carbon preference index, = $\Sigma(X_i + X_{i+2} + \dots + X_n) / \Sigma(X_{i-1} + X_{i+1} + \dots + X_{n-1})$, where X is concentration, i is the minimum long-chain carbon chain length, and n is the maximum carbon chain length.

^c Sterols: stigmasterol, campesterol, β -sitosterol, and stigmastanol.

^d Sterones: stigmasta-3,5-dien-7-one, sitosterone, and stigmastan-3-one.

nd = not detected

Table S2

Solvent extractable biomarker concentrations and biomarker proxies from the Upper Ptarmigan (UPt) soil profile at Cape Bounty Arctic Watershed Observatory.

Sample Depth	0 cm (mg/g OC)	5 cm (mg/g OC)	15 cm (mg/g OC)	30 cm (mg/g OC)	40 cm (mg/g OC)	70 cm (mg/g OC)
<i>n</i> -alkanes						
Long-chain Total	0.068 ± 0.006	0.103 ± 0.004	0.198 ± 0.012	0.188 ± 0.006	0.066 ± 0.002	0.089 ± 0.006
Short-chain Total	nd	nd	0.0081 ± 0.0003	0.0056 ± 0.0002	0.0032 ± 0.0002	0.0047 ± 0.0006
ACL ₁₉₋₃₃ ^a	26.6 ± 0.1	26.0 ± 0.1	25.5 ± 0.1	25.9 ± 0.1	25.3 ± 0.1	25.2 ± 0.2
CPI ₂₁₋₃₃ ^b	1.58 ± 0.28	1.17 ± 0.09	1.24 ± 0.15	1.32 ± 0.08	1.97 ± 0.12	1.72 ± 0.19
<i>n</i> -alkanols						
Long-chain Total	0.078 ± 0.007	0.051 ± 0.003	0.096 ± 0.007	0.128 ± 0.008	0.033 ± 0.002	0.054 ± 0.006
Short-chain Total	0.0028 ± 0.0005	0.006 ± 0.002	0.014 ± 0.004	0.009 ± 0.002	0.0072 ± 0.0005	0.007 ± 0.002
ACL ₁₆₋₃₀ ^a	23.6 ± 0.1	22.9 ± 0.2	22.7 ± 0.3	23.4 ± 0.3	22.5 ± 0.1	22.7 ± 0.2
CPI ₂₀₋₃₀ ^b	9.71 ± 2.06	6.10 ± 1.07	4.39 ± 0.86	7.68 ± 0.67	7.55 ± 1.45	5.52 ± 1.26
<i>n</i> -alkanoic acids						
Long-chain Total	0.0019 ± 0.0003	nd	0.047 ± 0.004	0.071 ± 0.006	0.023 ± 0.002	0.027 ± 0.002
Short-chain Total	0.022 ± 0.002	0.036 ± 0.002	0.311 ± 0.034	0.259 ± 0.016	0.072 ± 0.004	0.193 ± 0.020
ACL ₁₄₋₂₈ ^a	17.3 ± 0.1	16.8 ± 0.1	17.8 ± 0.1	18.3 ± 0.2	18.4 ± 0.1	17.6 ± 0.1
CPI ₂₀₋₂₈ ^b	undefined	undefined	2.85 ± 0.68	2.48 ± 0.48	1.45 ± 0.32	1.65 ± 0.31
Steroids						
Sterols ^c	0.060 ± 0.007	0.036 ± 0.006	0.028 ± 0.004	0.036 ± 0.002	0.013 ± 0.001	0.016 ± 0.004
Sterones ^d	nd	nd	nd	nd	nd	nd
Cholesterol	0.007 ± 0.001	0.009 ± 0.001	0.018 ± 0.003	0.020 ± 0.002	0.008 ± 0.001	0.012 ± 0.002
Ergosterol	nd	nd	nd	nd	nd	nd
Sugars						
Glucose	nd	nd	nd	nd	nd	nd
Mannose	nd	nd	nd	nd	nd	nd
Sucrose	0.011 ± 0.003	nd	nd	nd	nd	nd
Trehalose	0.123 ± 0.035	0.030 ± 0.004	0.018 ± 0.004	nd	nd	nd

^a ACL_{i-n}, average chain length, = $\Sigma(iX_i + \dots + nX_n) / \Sigma(X_i + \dots + X_n)$, where X is concentration, i is the minimum carbon chain length, and n is the maximum carbon chain length.

^b CPI_{i-n}, carbon preference index, = $\Sigma(X_i + X_{i+2} + \dots + X_n) / \Sigma(X_{i-1} + X_{i+1} + \dots + X_{n-1})$, where X is concentration, i is the minimum long-chain carbon chain length, and n is the maximum carbon chain length.

^c Sterols: stigmasterol, campesterol, β -sitosterol, and stigmasterol.

^d Sterones: stigmasta-3,5-dien-7-one, sitosterone, and stigmastan-3-one.

nd = not detected

Table S3

Solvent extractable biomarker concentrations and biomarker proxies from the Lower Ptarmigan (LPt) soil profile at Cape Bounty Arctic Watershed Observatory.

Sample Depth	0 cm (mg/g OC)	5 cm (mg/g OC)	15 cm (mg/g OC)	30 cm (mg/g OC)	40 cm (mg/g OC)	90 cm (mg/g OC)
<i>n</i> -alkanes						
Long-chain Total	0.488 ± 0.022	0.256 ± 0.018	0.212 ± 0.011	0.216 ± 0.013	0.249 ± 0.010	0.416 ± 0.024
Short-chain Total	nd	nd	nd	nd	nd	nd
ACL ₁₉₋₃₃ ^a	29.0 ± 0.1	26.3 ± 0.1	26.4 ± 0.1	26.6 ± 0.1	26.2 ± 0.2	27.5 ± 0.1
CPI ₂₁₋₃₃ ^b	15.6 ± 1.4	2.99 ± 0.52	3.63 ± 0.50	3.41 ± 0.48	3.25 ± 0.23	7.70 ± 1.01
<i>n</i> -alkanols						
Long-chain Total	0.560 ± 0.022	0.215 ± 0.005	0.252 ± 0.004	0.224 ± 0.004	0.249 ± 0.008	0.753 ± 0.017
Short-chain Total	0.004 ± 0.001	0.017 ± 0.003	0.014 ± 0.004	0.013 ± 0.003	0.021 ± 0.002	0.016 ± 0.001
ACL ₁₆₋₃₀ ^a	25.2 ± 0.1	23.8 ± 0.1	24.2 ± 0.1	23.9 ± 0.1	23.8 ± 0.1	24.6 ± 0.1
CPI ₂₀₋₃₀ ^b	8.00 ± 0.98	7.18 ± 0.74	11.4 ± 1.0	11.74 ± 1.31	16.6 ± 2.9	14.0 ± 1.2
<i>n</i> -alkanoic acids						
Long-chain Total	0.638 ± 0.034	0.164 ± 0.011	0.102 ± 0.006	0.117 ± 0.009	0.124 ± 0.011	0.214 ± 0.015
Short-chain Total	0.301 ± 0.019	0.399 ± 0.047	0.251 ± 0.023	0.233 ± 0.038	0.397 ± 0.045	0.254 ± 0.042
ACL ₁₄₋₂₈ ^a	21.8 ± 0.1	18.9 ± 0.2	18.8 ± 0.1	19.3 ± 0.1	18.7 ± 0.1	20.1 ± 0.2
CPI ₂₀₋₂₈ ^b	5.04 ± 0.56	3.63 ± 0.6	3.34 ± 0.52	3.57 ± 0.59	3.94 ± 0.67	4.01 ± 0.54
Steroids						
Sterols ^c	1.322 ± 0.027	0.560 ± 0.046	0.598 ± 0.029	0.537 ± 0.033	0.555 ± 0.022	1.129 ± 0.060
Sterones ^d	0.319 ± 0.015	0.086 ± 0.008	0.097 ± 0.011	0.078 ± 0.006	0.072 ± 0.010	0.123 ± 0.015
Cholesterol	0.097 ± 0.002	0.053 ± 0.007	0.043 ± 0.006	0.037 ± 0.006	0.032 ± 0.002	0.046 ± 0.005
Ergosterol	0.082 ± 0.002	0.028 ± 0.006	0.026 ± 0.006	0.017 ± 0.006	0.019 ± 0.003	0.014 ± 0.001
Sugars						
Glucose	0.178 ± 0.028	0.019 ± 0.002	0.015 ± 0.004	nd	0.009 ± 0.002	0.0055 ± 0.0003
Mannose	0.194 ± 0.031	0.020 ± 0.002	0.009 ± 0.002	nd	0.007 ± 0.001	0.004 ± 0.001
Sucrose	1.109 ± 0.079	0.122 ± 0.023	0.061 ± 0.016	0.014 ± 0.004	0.029 ± 0.007	0.023 ± 0.004
Trehalose	3.381 ± 0.196	0.683 ± 0.096	0.104 ± 0.010	0.059 ± 0.019	0.052 ± 0.009	0.067 ± 0.010

^a ACL_{i-n}, average chain length, = $\Sigma(iX_i + \dots + nX_n) / \Sigma(X_i + \dots + X_n)$, where X is concentration, i is the minimum carbon chain length, and n is the maximum carbon chain length.

^b CPI_{i-n}, carbon preference index, = $\Sigma(X_i + X_{i+2} + \dots + X_n) / \Sigma(X_{i-1} + X_{i+1} + \dots + X_{n-1})$, where X is concentration, i is the minimum long-chain carbon chain length, and n is the maximum carbon chain length.

^c Sterols: stigmasterol, campesterol, β -sitosterol, and stigmastanol.

^d Sterones: stigmasta-3,5-dien-7-one, sitosterone, and stigmastan-3-one.

nd = not detected

Fig. S1

Photographs from the ALD-impacted area of the Ptarmigan catchment of the Cape Bounty Arctic Watershed Observatory: (A) the exposed Upper Ptarmigan (UPt) scar zone; (B) the Lower Ptarmigan (LPt) sliding zone showing evidence of lateral compression ridge formation. Photographs taken [July 25 2012] (photographer: M.J. Lafrenière)

Fig. S2

Distribution of *n*-alkanes extracted from depth profiles of permafrost soil in three study areas of the Cape Bounty Arctic Watershed Observatory.

Fig. S3

Distribution of *n*-alkanols extracted from depth profiles of permafrost soil in three study areas of the Cape Bounty Arctic Watershed Observatory.

Fig. S4

Distribution of *n*-alkanoic acids extracted from depth profiles of permafrost soil in three study areas of the Cape Bounty Arctic Watershed Observatory.