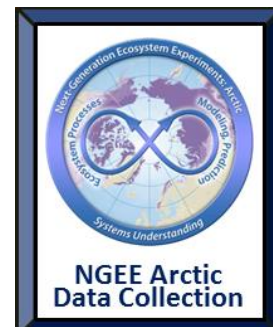


Organic Carbon Transformation and Mercury Methylation in Tundra Soils from Barrow, Alaska

Review and follow the current NGEE Data and Fair-Use Policies prior to using these data (<http://ngee-arctic.ornl.gov/content/ngee-arctic-data-management-policies-and-plans>).



Summary:

This data set report the results of the consumption and production of labile soil organic carbon (SOC) in an anoxic incubation experiment using soil samples from the active layer collected in 2012 at the Barrow Environmental Observatory, Barrow, Alaska, USA (Yang et al., 2016).

Free-reducing sugars, alcohols, and low-molecular-weight (LMW) organic acids were analyzed during incubation at either -2 or 8 degrees C for up to 240 days. Results show that degradation of simple sugar and alcohol in SOC largely accounts for the initial rapid release of CO₂ and CH₄ through anaerobic fermentation, whereas the fermentation products, acetate and formate, are subsequently utilized as primary substrates for methanogenesis. Iron(III) reduction is correlated with acetate production and methanogenesis, suggesting its important role as an electron acceptor in SOC respiration in tundra environment.

Mercury methylation in tundra soils, under similar incubation conditions, as described in Yang et al. (2016b) is also reported.

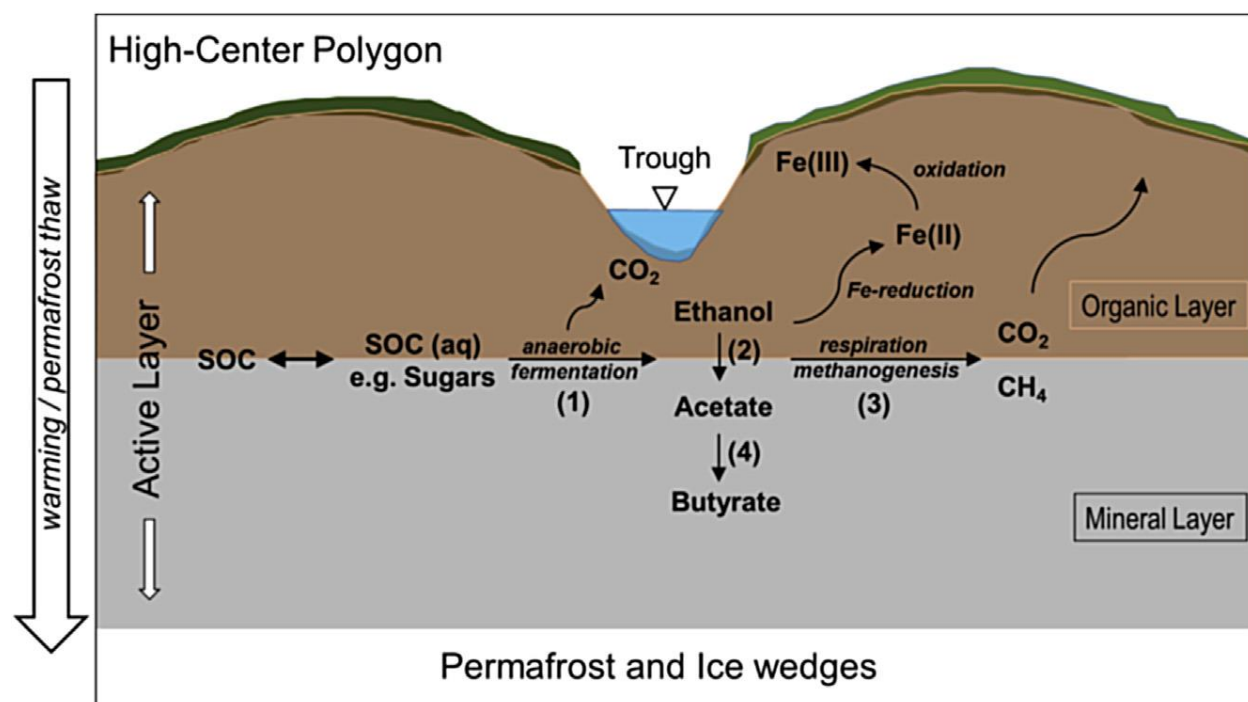


Figure 1. Conceptual model of anaerobic soil organic carbon (SOC) degradation pathways and the production or consumption of labile organic carbon substrates in the active layer upon warming. From Yang et al., 2016.

Please use this citation to reference the data:

Ziming Yang and Baohua Gu. 2016. Organic Carbon Transformation and Mercury Methylation in Tundra Soils from Barrow, Alaska. Next Generation Ecosystem Experiments Arctic Data Collection, Carbon Dioxide Information Analysis Center, Oak Ridge National Laboratory, Oak Ridge, Tennessee, USA. Data set accessed at <http://dx.doi.org/10.5440/1235032>.

Please use this citation for the related publication:

Ziming Yang, Stan D. Wullschleger, Liyuan Liang, David E. Graham, Baohua Gu. **Effects of warming on the degradation and production of low-molecular-weight labile organic carbon in an Arctic tundra soil.** Soil Biology and Biochemistry, Volume 95, April 2016, Pages 202-211, ISSN 0038-0717, <http://dx.doi.org/10.1016/j.soilbio.2015.12.022>.

Data Characteristics:

There is one comma-separated (.csv) file provided with this data set.

Quality Flag Note: For certain measured variables a quality flag, *_FL, is also reported. The flag may have values of: V0 = Valid value; V1 = Valid value but comprised wholly or partially of below detection limit data; or M1 = Missing value because no value is available -- not analyzed.

“Zero” Value Note: For certain measured variables, when the reported value is zero (0.00), the measured value was considered undetectable. The quality flag will be “V1”.

Data Dictionary:

Column Names	Units/format	Description
CORE_ID		NGEE Arctic core identifier
Date_sampled	YYYY-MM-DD	Date core collected. Exact day in April, 2012 not recorded. Set to day 16.
Longitude	decimal degrees	Core sampling location.

Latitude	decimal degrees	Core sampling location.
Region		North Slope
Locale		Barrow
Site		Intensive Site 1
Area		A
Polygonal_type		high-centered
Microtopography		trough, ridge, center
SOIL_LAYER		organic or mineral
UPPER_DEPTH_SOIL_LAYER	cm	Depth at top of soil core increment section
LOWER_DEPTH_SOIL_LAYER	cm	Depth at bottom of soil core increment section
WATER_CONTENT	g/g dwt	Gravimetric water content of core sample. Average of triplicate (3) measurements. Methods as described previously (Roy Chowdhury et al., 2015).
WATER_CONTENT_SD	g/g dwt	One (1) standard deviation of average of triplicate measurements
DISSOLVED_ORGANIC_CARBON	umol/g	Average of triplicate (3) measurements of core samples. Methods as described previously (Roy Chowdhury et al., 2015).
DISSOLVED_ORGANIC_CARBON_SD	umol/g	One (1) standard deviation of average of triplicate measurements
TOTAL_ORGANIC_CARBON	mmol/g	Average of triplicate (3) measurements of core samples. Methods as described previously (Roy Chowdhury et al., 2015).
TOTAL_ORGANIC_CARBON_SD	mmol/g	One (1) standard deviation of average of triplicate measurements
INCUBATION_TIME	day	Length of incubation at time of sample collection. Up to 240 days.
INCUBATION_TEMP	deg_C	Incubation temperature was either -2 or 8 degrees C.
METHYL_MERCURY	ng/g	Average of triplicate (3) measurements.
METHYL_MERCURY_SD	ng/g	One (1) standard deviation of average of triplicate measurements
METHYL_MERCURY_DL	ng/g	Analytical detection limit

METHYL_MERCURY_FL		Quality flag: V0 = Valid value; M1 = Missing value because no value is available -- not analyzed
SUGAR	umol/g	Average of triplicate (3) measurements. Methods as described previously (Roy Chowdhury et al., 2015).
SUGAR_SD	umol/g	One (1) standard deviation of average of triplicate measurements
SUGAR_DL	umol/g	Analytical detection limit
SUGAR_FL		Quality flag: V0 = Valid value; M1 = Missing value because no value is available -- not analyzed
ETHANOL	umol/g	Average of triplicate (3) measurements.
ETHANOL_SD	umol/g	One (1) standard deviation of average of triplicate measurements
ETHANOL_DL	umol/g	Analytical detection limit
ETHANOL_FL		Quality flag: V0 = Valid value; M1 = Missing value because no value is available -- not analyzed
ACETATE	umol/g	Average of triplicate (3) measurements.
ACETATE_SD	umol/g	One (1) standard deviation of average of triplicate measurements
ACETATE_DL	umol/g	Analytical detection limit
ACETATE_FL		Quality flag: V0 = Valid value; M1 = Missing value because no value is available -- not analyzed
FORMATE	umol/g	Average of triplicate (3) measurements. Note that values of zero (0.00) indicate that formate was undetectable.
FORMATE_SD	umol/g	One (1) standard deviation of average of triplicate measurements
FORMATE_DL	umol/g	Analytical detection limit
FORMATE_FL		Quality flag: V0 = Valid value; V1 = Valid value but comprised wholly or partially of below detection limit data; M1 = Missing value because no value is available - - not analyzed
PROPIONATE	umol/g	Average of triplicate (3) measurements. Note that values of zero (0.00) indicate that propionate was undetectable.
PROPIONATE_SD	umol/g	One (1) standard deviation of average of triplicate measurements

PROPIONATE_DL	umol/g	Analytical detection limit
PROPIONATE_FL		Quality flag: V0 = Valid value; V1 = Valid value but comprised wholly or partially of below detection limit data; M1 = Missing value because no value is available - - not analyzed
BUTYRATE	umol/g	Average of triplicate (3) measurements. Note that values of zero (0.00) indicate that butyrate was undetectable.
BUTYRATE_SD	umol/g	One (1) standard deviation of average of triplicate measurements
BUTYRATE_DL	umol/g	Analytical detection limit
BUTYRATE_FL		Quality flag: V0 = Valid value; V1 = Valid value but comprised wholly or partially of below detection limit data; M1 = Missing value because no value is available - - not analyzed
CH4	umol/g dwt	Average of triplicate (3) measurements.
CH4_SD	umol/g dwt	One (1) standard deviation of average of triplicate measurements
CH4_DL	umol/g dwt	Analytical detection limit
CH4_FL		Quality flag: V0 = Valid value; M1 = Missing value because no value is available -- not analyzed
CO2	umol/g dwt	Average of triplicate (3) measurements.
CO2_SD	umol/g dwt	One (1) standard deviation of average of triplicate measurements
CO2_DL	umol/g dwt	Analytical detection limit
CO2_FL		Quality flag: V0 = Valid value; M1 = Missing value because no value is available -- not analyzed
Fe(II)/Fe(TOTAL)	ratio	Ratio of Fe(II) to Fe(TOTAL). Average of triplicate (3) measurements.
Fe(II)/Fe(TOTAL)_SD	ratio	One (1) standard deviation of average of triplicate measurements

Data Acquisition Materials and Methods:

Soil sampling and processing, soil microcosm incubations, and analytical techniques are described in detail in Yang et al., 2016. The paper is included as a companion file to this data set.

References:

Roy Chowdhury, T., Herndon, E.M., Phelps, T.J., Elias, D.A., Gu, B.H., Liang, L.Y., Wulfschleger, S.D., Graham, D.E., 2015. Stoichiometry and temperature sensitivity of methanogenesis and CO₂ production from saturated polygonal tundra in Barrow, Alaska. *Global Change Biology* 21, 722e737.

Ziming Yang, Stan D. Wulfschleger, Liyuan Liang, David E. Graham, Baohua Gu. Effects of warming on the degradation and production of low-molecular-weight labile organic carbon in an Arctic tundra soil. *Soil Biology and Biochemistry*, Volume 95, April 2016, Pages 202-211, ISSN 0038-0717, <http://dx.doi.org/10.1016/j.soilbio.2015.12.022>.

Ziming Yang, Wei Fang, Xia Lu, Guo-Ping Sheng, David E. Graham, Liyuan Liang, Stan D. Wulfschleger, and Baohua Gu. 2016b. Warming increases methylmercury production in an Arctic soil. *Environmental Pollution*. Accepted April 19, 2016.

Data Access:

Disclaimer of Liability

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