Vascular plant and microbial biomarkers of dissolved organic matter data from incubation experiments

Website: https://www.bco-dmo.org/dataset/754885
Data Type: Cruise Results
Version: 1
Version Date: 2019-04-05

Project
» Collaborative Research: Calibration and application of vascular plant and aqueous microbial biomarkers to examine transformations of dissolved organic matter (DOM biomarkers)

Contributors	Affiliation	Role
Hernes, Peter	University of California-Davis (UC Davis)	Principal Investigator
Kaiser, Karl	Texas A&M University (TAMU)	Co-Principal Investigator
Spencer, Robert	Florida State University (FSU)	Contact
Rauch, Shannon	Woods Hole Oceanographic Institution (WHOI BCO-DMO)	BCO-DMO Data Manager

Abstract
Incubation experiments were conducted in the dark or using a dark/light cycle. Incubations conducted in the dark alone are classified as "microbial, and incubations using a dark/light cycle are classified as "coupled".

Table of Contents

Dataset Description

Incubation experiments were conducted in the dark or using a dark/light cycle. Incubations conducted in the dark alone are classified as "microbial, and incubations using a dark/light cycle are classified as "coupled".

Methods & Sampling

Samples were collect on the USGS R/V Mary Landsteiner and pumped directly from the surface (1 m deep) with a pump and clean tycoon tubing connected to an inline 0.2 um Whatman Polycap filter.

Incubation experiments were conducted in the dark or using a dark/light cycle. Incubations conducted in the dark alone are classified as "microbial, and incubations using a dark/light cycle are classified as "coupled".

All filters were pumped and field filtered through 0.7 um Whatman glass fiber filters (GF/F, precombusted at 550 degrees C) using a peristaltic pump after purging the line.

Samples for DOC concentration were acidified to pH 2 and stored in a refrigerator (4 degrees C) until analysis by high-temperature combustion on a Shimadzu TOC-L CPH within two weeks following collection. DOC was calculated as the mean of between three and five injections using a six-point standard curve using established protocols (Mann et al., 2012) and the coefficient of variance was always <2%.

Samples for CDOM absorbance were analyzed in a 1 cm cuvette on a Horiba Aqualog-UV-800-C. Absorbance spectra were measured from 230-800 nm, and corrected for a small offset either due to long-term baseline drift or derived from glass fiber particles during filtration (Blough et al., 1993), by subtracting the mean absorbance measured between 750-800 nm. Two spectral slopes were calculated at 275-295 nm and 350-400 nm (S275-295 and S350-400, respectively), and the spectral slope ratio (SR) was then calculated by dividing the former by the latter (Helms et al., 2008). The CDOM absorption ratio at 250 nm to 365 nm was calculated (a250:a365) and specific ultraviolet absorbance (SUVA254) was calculated by dividing the decadic absorption coefficient at 254 nm by DOC concentration (Weishaar et al., 2003; Fellman et al., 2009).

Fluorescence properties of FDOM were determined using a Horiba Aqualog-UV-800-C. The excitation emission matrices (EEMs) were generated in a 1 cm cuvette at varying integration times (1-10 seconds) to maximize the signal-to-noise ratio based on absorbance values. The EEMs were obtained at excitation (ex) 250-600 nm and at emission (em) 250-600 nm with 5 nm and 2 nm intervals respectively, and the EEMs were corrected for lamp intensity (Cory et al., 2010), inner filter effects (Kothawala et al., 2013), and normalized to Raman units (R.U.) (Stedmon et al., 2003). All corrections were performed using the FDOMcorr toolbox version 1.6 (Murphy, 2011). EEMs were analyzed with parallel factor analysis (PARAFAC) using the procedure described in Murphy et al. (2013). Furthermore, the fluorescence index (FI) (Cory et al., 2010), humification index (HIX) (Ohno, 2002; Zsolnay et al., 1999), and autotrophic productivity index (BIX) (Huguet et al., 2009) were calculated. FI was calculated from the emission wavelengths at 470 nm and 520 nm, obtained at excitation 370 nm (Cory and McKnight, 2005). HIX was calculated using the area under the emission sepctra 435-480 nm divided by the peak area 300-345 + 435-480 nm, at excitation 254 nm (Ohno, 2002). BIX was calculated from the emission intensity of 380 nm and 430 nm, obtained at excitation 310 nm (Wang et al., 2014).

Samples for FT-ICR MS analysis were solid-phase extracted using the procedure described in Dittmar et al., 2008. Filtered samples were acidified to pH 2 before solid phase extraction on 500 mg Agilent Bond Elut PPL cartridges. Each 1 L sample was extracted by eluting 2 mL of of methanol and then diluted to a DOC target concentration of 50 ug C mL-1. Extracted samples were stored at -20 degrees C prior to analysis on a 21 T (Bruker Daltonics, Billerica, MA, USA) FT-ICR MS located at the National High Magnetic Field Laboratory (NHMFL) (Tallahassee, Florida). Direct infusion electrospray ionization (ESI) generates negative ions at a flow rate of 700 nL min-1, and 100 time domain acquisitions were coadded for each mass spectrum.

Molecular formulas were assigned to signals >6RMS baseline noise with EnviroOrg ©,TM software (Koch et al., 2007; Stubbins et al., 2010). Elemental combinations of C1–45H1–92N0–4O1–25S0–2 with a mass accuracy of ≤300 ppb were considered for assignment. Classification of formulas were based on their elemental ratios (Corilo, 2015). The modified aromaticity index (Almod) of each formula was calculated and Almod values of 0.5-0.67 and ≥0.67 were classified as aromatic and condensed aromatic structures (Koch and Dittmar, 2006; Koch and Dittmar, 2016). Other compound classes were unsaturated low oxygen=Almod<0.5, H/C<1.5, O/C<0.5; unsaturated high oxygen=Almod<0.5, H/ C<1.5, O/C>0.5; aliphatics=H/C 1.5-2.0, O/C<0.9, N=0; peptide-like=H/C 1.5-2.0, O/C<0.9, N>0, and sugar-like= O/C>0.9. Sugar-like compounds provide a very minor contribution to %RA (mean = 0.05, ± 0.06 %RA) and so were combined with peptide-like compounds throughout. Although FT-ICR MS allows for the precise assignment of molecular formulas to signals that may represent multiple isomers, they describe the underlying molecular compounds comprising DOM, thus the term compound may be used when describing the signals detected by FT-ICR MS.

Lignin derived phenols were isolated from the dried solid phase extracts followed by cupric oxide oxidation and liquid-liquid extraction modified from Spencer et al., (2010). Briefly, PPL extracts were redissolved in O2 free 2 M NaOH in a 6 mL Teflon vial (Savillex Corp) containing 500 mg CuO, and amended with 100 mg ferrous ammonium sulfate and 50 mg glucose and reacted in a 155 degree C oven for 3 hours. Following oxidation, the samples were centrifuged and supernatants were decanted into 40 mL vials. Oxidation products were acidified to pH 1 with H3PO4 and t-cinnamic acid was added as an internal standard. Liquid-liquid extractions of the oxidation products were undertaken by addition of 4 mL ethyl acetate, vortexing, and centrifugation prior to removal of the ethyl acetate. Extracts were pipetted through drying columns containing sodium sulfate into a 4 mL vial. Samples were dried under ultra-high purity argon between each extraction for a total of three extractions, following the last extraction the sodium sulfate was rinsed with 1 mL of ethyl acetate into the extract vial. Dried ethyl acetate extracts were dissolved in pyridine and derivatized with N/O bis-trimethylsilyltrifluoromethylacetamide (BSTFA) at 60 degrees C for ten minutes. Lignin phenol monomers were measured as trimethylsilane derivatives using an Agilent 6890N GC/5975 MS and were quantified as the relative response factors of each compound compared to the response of t- cinnamic acid and a five-point calibration curve bracketing the concentration range. Eight lignin phenols from three phenol groups were quantified; vanillyl (vanillin, acetovanillone, vanillic acid), syringyl (syringaldehyde, acetosyringone, syringic acid), and coumaryl (coumaric acid, ferulic acid).

Seven neutral sugars (fucose, rhamnose, arabinose, galactose, glucose, mannose, xylose) were analyzed

according to Skoog and Benner (1997) with modifications. Briefly, samples were hydrolyzed in 1.2 mol L−1 sulfuric acid and neutralized with a self-absorbed ion retardation resin (Kaiser and Benner, 2000). After desalting with a mixture of cation and anion exchange resins, neutral sugars were isocratically separated with 25 mM NaOH on a PA 1 column in a Dionex 500 system with a pulsed amperiometric detector (PAD).

The following amino acids were analyzed using the method of Kaiser and Benner, 2005: histidine, serine, arginine, glycine, aspartic acid, glutamic acid, threonine, alanine, lysine, tyrosine, methionine, valine, norvaline, isoleucine, leucine, phenylalanine.

Data Processing Description

BCO-DMO Processing:
- modified parameter names to conform with BCO-DMO naming conventions (removed units, replaced spaces with underscores);
- replaced "NaN" with "nd" (no data).

[table of contents | back to top]

Data Files

File
incubation_data.csv (Comma Separated Values (.csv), 39.00 KB) MD5:6375517a8d1e70676b6cf0d20683a73c Primary data file for dataset ID 754885

[table of contents | back to top]

Related Publications

Blough, N. V., Zafiriou, O. C., & Bonilla, J. (1993). Optical absorption spectra of waters from the Orinoco River outflow: Terrestrial input of colored organic matter to the Caribbean. Journal of Geophysical Research: Oceans, 98(C2), 2271–2278. doi:10.1029/92jc02763 https://doi.org/10.1029/92JC02763
Methods

Corilo, Y. (2015) PetroOrg Software; Florida State University: Tallahassee, FL, 2014.
Methods

Cory, R. M., & McKnight, D. M. (2005). Fluorescence Spectroscopy Reveals Ubiquitous Presence of Oxidized and Reduced Quinones in Dissolved Organic Matter. Environmental Science & Technology, 39(21), 8142–8149. doi:10.1021/es0506962
Methods

Cory, R. M., Miller, M. P., McKnight, D. M., Guerard, J. J., & Miller, P. L. (2010). Effect of instrument-specific response on the analysis of fulvic acid fluorescence spectra. Limnology and Oceanography: Methods, 8(2), 67–78. doi:10.4319/lom.2010.8.67
Methods

Dittmar, T., Koch, B., Hertkorn, N., & Kattner, G. (2008). A simple and efficient method for the solid-phase extraction of dissolved organic matter (SPE-DOM) from seawater. Limnology and Oceanography: Methods, 6(6), 230–235. doi:10.4319/lom.2008.6.230
Methods

Fellman, J. B., Hood, E., D'Amore, D. V., Edwards, R. T., & White, D. (2009). Seasonal changes in the chemical quality and biodegradability of dissolved organic matter exported from soils to streams in coastal temperate rainforest watersheds. Biogeochemistry, 95(2-3), 277–293. doi:10.1007/s10533-009-9336-6
Methods

Helms, J. R., Stubbins, A., Ritchie, J. D., Minor, E. C., Kieber, D. J., & Mopper, K. (2008). Absorption spectral slopes and slope ratios as indicators of molecular weight, source, and photobleaching of chromophoric dissolved organic matter. Limnology and Oceanography, 53(3), 955–969. doi:10.4319/lo.2008.53.3.0955

Methods

Huguet, A., Vacher, L., Relexans, S., Saubusse, S., Froidefond, J. M., & Parlanti, E. (2009). Properties of fluorescent dissolved organic matter in the Gironde Estuary. Organic Geochemistry, 40(6), 706–719. doi:10.1016/j.orggeochem.2009.03.002
Methods

Kaiser, K., & Benner, R. (2005). Hydrolysis-induced racemization of amino acids. Limnology and Oceanography: Methods, 3(8), 318–325. doi:10.4319/lom.2005.3.318
Methods

Koch, B. P., & Dittmar, T. (2006). From mass to structure: an aromaticity index for high-resolution mass data of natural organic matter. Rapid Communications in Mass Spectrometry, 20(5), 926–932. doi:10.1002/rcm.2386
Methods

Koch, B. P., & Dittmar, T. (2015). From mass to structure: an aromaticity index for high-resolution mass data of natural organic matter. Rapid Communications in Mass Spectrometry, 30(1), 250–250. doi:10.1002/rcm.7433
Methods

Koch, B. P., Dittmar, T., Witt, M., & Kattner, G. (2007). Fundamentals of Molecular Formula Assignment to Ultrahigh Resolution Mass Data of Natural Organic Matter. Analytical Chemistry, 79(4), 1758–1763. doi:10.1021/ac061949s
Methods

Kothawala, D. N., Murphy, K. R., Stedmon, C. A., Weyhenmeyer, G. A., & Tranvik, L. J. (2013). Inner filter correction of dissolved organic matter fluorescence. Limnology and Oceanography: Methods, 11(12), 616–630. doi:10.4319/lom.2013.11.616
Methods

Mann, P. J., Davydova, A., Zimov, N., Spencer, R. G. M., Davydov, S., Bulygina, E., … Holmes, R. M. (2012). Controls on the composition and lability of dissolved organic matter in Siberia's Kolyma River basin. Journal of Geophysical Research: Biogeosciences, 117(G1). doi:10.1029/2011jg001798 https://doi.org/10.1029/2011JG001798
Methods

Murphy, K. R. (2011). A Note on Determining the Extent of the Water Raman Peak in Fluorescence Spectroscopy. Applied Spectroscopy, 65(2), 233–236. doi:10.1366/10-06136
Methods

Ohno, T. (2002). Fluorescence Inner-Filtering Correction for Determining the Humification Index of Dissolved Organic Matter. Environmental Science & Technology, 36(4), 742–746. doi:10.1021/es0155276
Methods

Skoog, A., & Benner, R. (1997). Aldoses in various size fractions of marine organic matter: Implications for carbon cycling. Limnology and Oceanography, 42(8), 1803–1813. doi:10.4319/lo.1997.42.8.1803
Methods

Spencer, R. G. M., Aiken, G. R., Dyda, R. Y., Butler, K. D., Bergamaschi, B. A., & Hernes, P. J. (2010). Comparison of XAD with other dissolved lignin isolation techniques and a compilation of analytical improvements for the analysis of lignin in aquatic settings. Organic Geochemistry, 41(5), 445–453. doi:10.1016/j.orggeochem.2010.02.004
Methods

Stedmon, C. A., Markager, S., & Bro, R. (2003). Tracing dissolved organic matter in aquatic environments using a new approach to fluorescence spectroscopy. Marine Chemistry, 82(3-4), 239–254. doi:10.1016/s0304-4203(03)00072-0 https://doi.org/10.1016/S0304-4203(03)00072-0
Methods

Stubbins, A., Spencer, R. G. M., Chen, H., Hatcher, P. G., Mopper, K., Hernes, P. J., … Six, J. (2010). Illuminated darkness: Molecular signatures of Congo River dissolved organic matter and its photochemical alteration as revealed by ultrahigh precision mass spectrometry. Limnology and Oceanography, 55(4), 1467–1477. doi:10.4319/lo.2010.55.4.1467
Methods

Wang, Y., Zhang, D., Shen, Z., Chen, J., & Feng, C. (2014). Characterization and spacial distribution variability of chromophoric dissolved organic matter (CDOM) in the Yangtze Estuary. Chemosphere, 95, 353–362. doi:10.1016/j.chemosphere.2013.09.044

Methods

Weishaar, J. L., Aiken, G. R., Bergamaschi, B. A., Fram, M. S., Fujii, R., & Mopper, K. (2003). Evaluation of Specific Ultraviolet Absorbance as an Indicator of the Chemical Composition and Reactivity of Dissolved Organic Carbon. Environmental Science & Technology, 37(20), 4702–4708. doi:10.1021/es030360x
Methods

Zsolnay, A., Baigar, E., Jimenez, M., Steinweg, B., & Saccomandi, F. (1999). Differentiating with fluorescence spectroscopy the sources of dissolved organic matter in soils subjected to drying. Chemosphere, 38(1), 45–50. doi:10.1016/s0045-6535(98)00166-0 https://doi.org/10.1016/S0045-6535(98)00166-0
Methods

[table of contents | back to top]

Parameters

Parameter	Description	Units
incubation_type	Incubations conducted in the dark alone are classified as "microbial, and incubations using a dark/light cycle are classified as "coupled".	unitless
site_type	Sample type?	unitless
time_point	Time point	unitless
days	Time elapsed (days)	days
hours	Time elapsed (hours)	hours
Exposure	Exposure time	hours
Dose	Dose	MJ/m2
Irradiance	Irradiance	W/m2
DOC_mg_L	Dissolved organic carbon in milligrams per liter	mg/L
DOC_mM	Dissolved organic carbon in millimolar	mM
Fuc	Fucose	nanomoles per liter (nmol/L)
Rha	Rhamnose	nanomoles per liter (nmol/L)
Ara	Arabinose	nanomoles per liter (nmol/L)
Gal	Galactose	nanomoles per liter (nmol/L)
Glu	Glucose	nanomoles per liter (nmol/L)
Man	Mannose	nanomoles per liter (nmol/L)
Xyl	Xylose	nanomoles per liter (nmol/L)
D_Asx	D-Aspartate or D-Asparagine	nanomoles per liter (nmol/L)
L_Asx	L-Aspartate or L-Asparagine	nanomoles per liter (nmol/L)
D_Glx	D-Glutamate or D-Glutamine	nanomoles per liter (nmol/L)
L_Glx	L-Glutamate or L-Glutamine	nanomoles per liter (nmol/L)

D_Ser	D-Serine	nanomoles per liter (nmol/L)
L_Ser	L-Serine	nanomoles per liter (nmol/L)
D_His	D-Histidine	nanomoles per liter (nmol/L)
L_His	L-Histidine	nanomoles per liter (nmol/L)
D_Thr	D-Threonine	nanomoles per liter (nmol/L)
L_Thr	L-Threonine	nanomoles per liter (nmol/L)
Gly	Glycine	nanomoles per liter (nmol/L)
D_Arg	D-Arginine	nanomoles per liter (nmol/L)
L_Arg	L-Arginine	nanomoles per liter (nmol/L)
D_Ala	D-Alanine	nanomoles per liter (nmol/L)
L_Ala	L-Alanine	nanomoles per liter (nmol/L)
D_Tyr	D-Tyrosine	nanomoles per liter (nmol/L)
L_Tyr	L-Tyrosine	nanomoles per liter (nmol/L)
D_Val	D-Valine	nanomoles per liter (nmol/L)
L_Val	L-Valine	nanomoles per liter (nmol/L)
D_Met	D-Methionine	nanomoles per liter (nmol/L)
L_Met	L-Methionine	nanomoles per liter (nmol/L)
D_Ileu	D-Isoleucine	nanomoles per liter (nmol/L)
L_Ileu	L-Isoleucine	nanomoles per liter (nmol/L)
D_Phe	D-Phenylalanine	nanomoles per liter (nmol/L)
L_Phe	L-Phenylalanine	nanomoles per liter (nmol/L)
D_Leu	D-Leucine	nanomoles per liter (nmol/L)
L_Leu	L-Leucine	nanomoles per liter (nmol/L)
D_Lys	D-Lysine	nanomoles per liter (nmol/L)
L_Lys	L-Lysine	nanomoles per liter (nmol/L)

FI	Fluorescence Index (DOM composition metric)	unitless
HIX	Humification Index (DOM composition metric)	unitless
HIX_Norm	Humification Index Norm (DOM composition metric)	unitless
BIX	Autotrophic productivity index (DOM composition metric)	unitless
abs_250	CDOM absorbance at 250 nm	reciprocal meters (m-1)
abs_254	CDOM absorbance at 254 nm	reciprocal meters (m-1)
abs_350	CDOM absorbance at 350 nm	reciprocal meters (m-1)
abs_365	CDOM absorbance at 365 nm	reciprocal meters (m-1)
abs_412	CDOM absorbance at 412 nm	reciprocal meters (m-1)
abs_440	CDOM absorbance at 440 nm	reciprocal meters (m-1)
abs_ratio_250_365	Absorbance ratio; absorbance at 250/365	reciprocal meters (m-1)
S275_295	Spectral slope range 275-295	unitless
r2_of_fit	r2 of fit of S275_295	unitless
S350_400	Spectral slope range 350-400	unitless
r2_of_fit2	r2 of fit of S350_400	unitless
Sr	Spectral slope ratio (275-295/350-400)	unitless
C1	Fluorescence intensity of component 1	Raman units
C2	Fluorescence intensity of component 2	Raman units
C3	Fluorescence intensity of component 3	Raman units
C4	Fluorescence intensity of component 4	Raman units
C5	Fluorescence intensity of component 5	Raman units
C6	Fluorescence intensity of component 6	Raman units
C7	Fluorescence intensity of component 7	Raman units
C8	Fluorescence intensity of component 8	Raman units
C9	Fluorescence intensity of component 9	Raman units
C10	Fluorescence intensity of component 10	Raman units
Ctotal	Fluorescence intensity total	Raman units
C1_pcnt	Fluorescence intensity of component 1 as a percent	unitless (percent)
C2_pcnt	Fluorescence intensity of component 2 as a percent	unitless (percent)
C3_pcnt	Fluorescence intensity of component 1 as a percent	unitless (percent)
C4_pcnt	Fluorescence intensity of component 2 as a percent	unitless (percent)

C5_pcnt	Fluorescence intensity of component 1 as a percent	unitless (percent)
C6_pcnt	Fluorescence intensity of component 2 as a percent	unitless (percent)
C7_pcnt	Fluorescence intensity of component 1 as a percent	unitless (percent)
C8_pcnt	Fluorescence intensity of component 2 as a percent	unitless (percent)
C9_pcnt	Fluorescence intensity of component 1 as a percent	unitless (percent)
C10_pcnt	Fluorescence intensity of component 2 as a percent	unitless (percent)
PAL	p-hydroxybenzaldehyde	nanograms per liter (ng/L)
PON	p-hydroxyacetophenone	nanograms per liter (ng/L)
VAL	vanillin	nanograms per liter (ng/L)
VON	acetovanillone	nanograms per liter (ng/L)
PAD	p-hydroxybenzoic acid	nanograms per liter (ng/L)
SAL	syringaldehyde	nanograms per liter (ng/L)
VAD	vanillic acid	nanograms per liter (ng/L)
SON	acetosyringone	nanograms per liter (ng/L)
SAD	syringic acid	nanograms per liter (ng/L)
CAD	p-coumaric acid	nanograms per liter (ng/L)
FAD	ferulic acid	nanograms per liter (ng/L)

[table of contents | back to top]

Instruments

Dataset-specific Instrument Name	Horiba Aqualog-UV-800-C
Generic Instrument Name	Fluorometer
Dataset-specific Description	Samples for CDOM absorbance were analyzed in a 1 cm cuvette on a Horiba Aqualog-UV-800-C (benchtop fluorometer). Fluorescence properties of FDOM were also determined using a Horiba Aqualog-UV-800-C.
Generic Instrument Description	A fluorometer or fluorimeter is a device used to measure parameters of fluorescence: its intensity and wavelength distribution of emission spectrum after excitation by a certain spectrum of light. The instrument is designed to measure the amount of stimulated electromagnetic radiation produced by pulses of electromagnetic radiation emitted into a water sample or in situ.

Dataset-specific Instrument Name	FT-ICR MS
Generic Instrument Name	Fourier Transform Ion Cyclotron Resonance Mass Spectrometer
Dataset-specific Description	Samples were analyzed on a 21 T (Bruker Daltonics, Billerica, MA, USA) FT-ICR MS located at the National High Magnetic Field Laboratory (NHMFL) (Tallahassee, Florida).
Generic Instrument Description	In Fourier Transform Ion Cyclotron Resonance Mass Spectrometry, the mass-to-charge ratio (m/z) of an ion is experimentally determined by measuring the frequency at which the ion processes in a magnetic field. These frequencies, which are typically in the 100 KHz to MHz regime, can be measured with modern electronics making it possible to determine the mass of an ion to within +/- 0.000005 amu or 5 ppm.

Dataset-specific Instrument Name	Agilent 6890N GC/5975 MS
Generic Instrument Name	Gas Chromatograph
Dataset-specific Description	Lignin phenol monomers were measured as trimethylsilane derivatives using an Agilent 6890N GC/5975 MS.
Generic Instrument Description	Instrument separating gases, volatile substances, or substances dissolved in a volatile solvent by transporting an inert gas through a column packed with a sorbent to a detector for assay. (from SeaDataNet, BODC)

Dataset-specific Instrument Name	Dionex 500 system
Generic Instrument Name	Ion Chromatograph
Dataset-specific Description	Neutral sugars were isocratically separated in a Dionex 500 system with a pulsed amperiometric detector (PAD).
Generic Instrument Description	Ion chromatography is a form of liquid chromatography that measures concentrations of ionic species by separating them based on their interaction with a resin. Ionic species separate differently depending on species type and size. Ion chromatographs are able to measure concentrations of major anions, such as fluoride, chloride, nitrate, nitrite, and sulfate, as well as major cations such as lithium, sodium, ammonium, potassium, calcium, and magnesium in the parts-per-billion (ppb) range. (from http://serc.carleton.edu/microbelife/research_methods/biogeochemical/ic....)

Dataset-specific Instrument Name	Agilent 6890N GC/5975 MS
Generic Instrument Name	Mass Spectrometer
Dataset-specific Description	Lignin phenol monomers were measured as trimethylsilane derivatives using an Agilent 6890N GC/5975 MS.
Generic Instrument Description	General term for instruments used to measure the mass-to-charge ratio of ions; generally used to find the composition of a sample by generating a mass spectrum representing the masses of sample components.

Dataset-specific Instrument Name	Shimadzu TOC-L CPH
Generic Instrument Name	Shimadzu TOC-L Analyzer
Dataset-specific Description	DOC concentration was determined on a Shimadzu TOC-L CPH.
Generic Instrument Description	A Shimadzu TOC-L Analyzer measures DOC by high temperature combustion method. Developed by Shimadzu, the 680 degree C combustion catalytic oxidation method is now used worldwide. One of its most important features is the capacity to efficiently oxidize hard-to-decompose organic compounds, including insoluble and macromolecular organic compounds. The 680 degree C combustion catalytic oxidation method has been adopted for the TOC-L series. http://www.shimadzu.com/an/toc/lab/toc-l2.html

[table of contents | back to top]

Project Information

Collaborative Research: Calibration and application of vascular plant and aqueous microbial biomarkers to examine transformations of dissolved organic matter (DOM biomarkers)

Coverage: San Francisco Bay Delta

NSF abstract:
Organic matter (OM) fluxes between and within terrestrial and oceanic reservoirs play an important role in the global carbon cycle. A clearer understanding of OM dynamics is critical for understanding fundamental processes and effects on greenhouse gases and climate. At present, researchers have an abundance of analytical methods and tools for investigating dissolved organic matter (DOM) cycling, but the field struggles to move past a qualitative understanding of sources, processing, and fates toward a quantitative understanding. Researchers from University of California-Davis, Woods Hole Oceanographic Institute, and Texas A&M University will develop biomarker tools to advance quantitative understanding of DOM cycling in riverine and estuarine environments in California, specifically targeting vascular plant and microbial markers. Results from this study will allow for future biomarker studies to quantitatively address DOM source and processing in aquatic environments and improve the limited understanding of the fate of terrestrial DOM in the ocean.

Broader Impacts: This study will provide interdisciplinary scientific training and development for undergraduate and graduate students, including individuals from underrepresented groups. Results from the study will be disseminated to the public, California stakeholders, and college students to educate them about the carbon cycle.

[table of contents | back to top]

Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1464396
NSF Division of Ocean Sciences (NSF OCE)	OCE-1335622
NSF Division of Ocean Sciences (NSF OCE)	OCE-1333633

[table of contents | back to top]