Fall 2011 - Porewater Samples

Website: https://www.bco-dmo.org/dataset/644537
Version: 20 April 2016
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Project
» Collaborative Research: Degrading offshore permafrost as a source of methane on the East Siberian Arctic Shelf (East Siberian Arctic Shelf)

Contributors	Affiliation	Role
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Dataset Description

Fall 2011 - Porewater Samples

Methods & Sampling

Fall 2011 - Porewater Samples

Porewater samples collected for: Analytical Method Instrument Method Reference
Dissolved Organic Carbon High temperature combustion Shimadzu TOC-V http://www.pangaea.de/Projects/JGOFS/Methods/chap16.html;
Total Dissolved Nitrogen High temperature combustion/Chemiluminescence Shimadzu TOC-V with TN Unit Pan et al., Simultaneous Determination of Dissolved Organic Carbon and Total Dissolved Nitrogen on a Coupled Hig
Total Dissolved Phosphorus Spectrophotometry Shimadzu UV-1601 Solorzano, L., and Sharp, J. H. 1980. Determination of total dissolved phosphorus and particulate phosphorus in natural waters. Limnol. Oceanogr.
NOx (Nitrate + Nitrite) Flow Injection Autoanalyzer Lachat Instruments FIA+ 8000 Series Lachat Instruments FIA 8000 Autoanalyzer Method 31-107-04-1-A
Nitrite Flow Injection Autoanalyzer Lachat Instruments FIA+ 8000 Series Lachat Instruments FIA 8000 Autoanalyzer Method 31-107-04-1-A
Orthophosphate Flow Injection Autoanalyzer Lachat Instruments FIA+ 8000 Series Lachat Instruments FIA 8000 Autoanalyzer Method 31-115-01-1-H
Reactive Silicate Flow Injection Autoanalyzer Lachat Instruments FIA+ 8000 Series Lachat Instruments FIA 8000 Autoanalyzer Method 31-114-27-1-D
Ammonium Spectrophotometry Shimadzu UV-1601 Solorzano, L. 1969. Determination of ammonia in natural waters by the phenolhypochlorite method. Limnol. Oceanogr. 14: 799-801
Anions (Sulfate + Chloride) Ion Chromatography DIONEX ICS-2000 DIONEX Application Note 154: Determination of Inorganic Anions in Environmental Waters Using a Hydroxide-Selective Column.
Anaerobic Methane Oxidation Sediment incubations with 14CH4 Scintillation Counter Orcutt, B., et al. 2005. Molecular biogeochemistry of sulfate reduction, methanogenesis and the anaerobic oxidation of methane at Gu

References:

Joye SB, Bowles M.W., Samarkin V.A., Hunter K.S., Niemann H.. 2010. Biogeochemical signatures and microbial activity of different cold seep habitats along the Gulf of Mexico lower slope. Deep Sea Research. 10:doi:10.1016/j.dsr2.2010.06.001.

Joye SB, MacDonald I.R., Leifer I., Asper V.. 2011. Magnitude and oxidation potential of hydrocarbon gases released from the BP blowout. Nature Geoscience. 4:160-164.

Orcutt B.N., Samarkin V., Boetius A., Elvert M., Joye SB. 2005. Molecular biogeochemistry of sulfate reduction, methanogenesis and the anaerobic oxidation of methane at Gulf of Mexico methane seeps. Geochimica et Cosmochimica Acta. 69:4267-4281.

Data Processing Description

BCO-DMO Processing Notes
- Generated from original file "00908788_Joye_Fall-2011_Data-Summary.xlsx", Sheet: "Porewater Data" contributed by Samantha Joye
- Parameter names edited to conform to BCO-DMO naming convention found at Choosing Parameter Name
- "nd" (no data) inserted into blank cells
- blank rows removed
- "B.D.L." converted to "BDL" (periods removed) to avoid potential data errors downstream
- "N.S." converted to "NS" (periods removed) to avoid potential data errors downstream and for consistency

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Data Files

File
Fall2011_Porewater.csv (Comma Separated Values (.csv), 6.71 KB) MD5:f214601ca165dc139356c80f1a4c849f Primary data file for dataset ID 644537

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Parameters

Parameter	Description	Units
Porewater_ID	Porewater ID	dimensionless
Station	Station	dimensionless
Date	Date	text
Latitude	Station latitude (South is negative)	decimal degrees
Longitude	Station longitude (West is negative)	decimal degrees
Water_Depth	Water_Depth	meters
Depth_Range	Depth_Range	cbsf
DOC	DOC	uM
TDN	TDN	uM
NOx	NOx (Nitrate + Nitrite)	uM
NO2	NO2	uM
NH4	NH4	uM
TDP	TDP	uM
PO4	PO4	uM
Si	Si	uM
SO4	SO4	mM
Cl	Cl	mM
Anaerobic_Methane_Oxidation_Turnover_Constant_k	Anaerobic Methane Oxidation Turnover Constant k	1/d

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Instruments

Dataset-specific Instrument Name	Drill Core
Generic Instrument Name	Drill Core
Generic Instrument Description	A core drill is a drill specifically designed to remove a cylinder of material, much like a hole saw. The material left inside the drill bit is referred to as the core. Core drills are used frequently in mineral exploration where the coring may be several hundred to several thousand feet in length. The core samples are recovered and examined by geologists for mineral percentages and stratigraphic contact points. This gives exploration companies the information necessary to begin or abandon mining operations in a particular area.

Dataset-specific Instrument Name	Lachat Instruments FIA+ 8000 Series
Generic Instrument Name	Flow Injection Analyzer
Dataset-specific Description	Porewater samples collected for: NOx (Nitrate + Nitrite) Nitrite Orthophosphate Reactive Silicate Analytical Method: Flow Injection Autoanalyzer Instrument: Lachat Instruments FIA+ 8000 Series Method Reference(s): Lachat Instruments FIA 8000 Autoanalyzer Method 31-107-04-1-A Lachat Instruments FIA 8000 Autoanalyzer Method 31-115-01-1-H Lachat Instruments FIA 8000 Autoanalyzer Method 31-114-27-1-D
Generic Instrument Description	An instrument that performs flow injection analysis. Flow injection analysis (FIA) is an approach to chemical analysis that is accomplished by injecting a plug of sample into a flowing carrier stream. FIA is an automated method in which a sample is injected into a continuous flow of a carrier solution that mixes with other continuously flowing solutions before reaching a detector. Precision is dramatically increased when FIA is used instead of manual injections and as a result very specific FIA systems have been developed for a wide array of analytical techniques.

Dataset-specific Instrument Name	Gravity Core
Generic Instrument Name	Gravity Corer
Generic Instrument Description	The gravity corer allows researchers to sample sediment layers at the bottom of lakes or oceans. The coring device is deployed from the ship and gravity carries it to the seafloor. From: http://www.whoi.edu/instruments/viewInstrument.do?id=1079

Dataset-specific Instrument Name	DIONEX ICS-2000
Generic Instrument Name	Ion Chromatograph
Dataset-specific Description	Porewater samples collected for: Anions (Sulfate + Chloride) Analytical Method: Ion Chromatography Instrument: DIONEX ICS-2000 Method Reference: DIONEX Application Note 154: Determination of Inorganic Anions in Environmental Waters Using a Hydroxide-Selective Column
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	Scintillation Counter
Generic Instrument Name	Liquid Scintillation Counter
Dataset-specific Description	Porewater samples collected for: Anaerobic Methane Oxidation Analytical Method: Sediment incubations with 14CH4 Instrument: Scintillation Counter Method Reference: Orcutt, B., et al. 2005. Molecular biogeochemistry of sulfate reduction, methanogenesis and the anaerobic oxidation of methane at Gulf of Mexico methane seeps. GCA Vol. 69, No. 17, pp. 4267–4281
Generic Instrument Description	Liquid scintillation counting is an analytical technique which is defined by the incorporation of the radiolabeled analyte into uniform distribution with a liquid chemical medium capable of converting the kinetic energy of nuclear emissions into light energy. Although the liquid scintillation counter is a sophisticated laboratory counting system used to quantify the activity of particulate emitting (ß and a) radioactive samples, it can also detect the auger electrons emitted from 51Cr and 125I samples. Liquid scintillation counters are instruments assaying alpha and beta radiation by quantitative detection of visible light produced by the passage of rays or particles through a suitable scintillant incorporated into the sample.

Dataset-specific Instrument Name	Shimadzu TOC-V
Generic Instrument Name	Shimadzu TOC-V Analyzer
Dataset-specific Description	Porewater samples collected for: Dissolved Organic Carbon Analytical Method: High temperature combustion Instrument: Shimadzu TOC-V Method Reference: http://www.pangaea.de/Projects/JGOFS/Methods/chap16.html
Generic Instrument Description	A Shimadzu TOC-V Analyzer measures DOC by high temperature combustion method.

Dataset-specific Instrument Name	Shimadzu TOC-V with TN Unit
Generic Instrument Name	Shimadzu TOC-V Analyzer
Dataset-specific Description	Porewater samples collected for: Total Dissolved Nitrogen Analytical Method: High temperature combustion/Chemiluminescence Instrument: Shimadzu TOC-V with TN Unit Method Reference: Pan et al., Simultaneous Determination of Dissolved Organic Carbon and Total Dissolved Nitrogen on a Coupled High-Temperature Combustion Total Organic Carbon-Nitrogen Chemiluminescence Detection (HTC TOC-NCD) System. Journal of Automated Methods & Management in Chemistry, 2005 (2005), no. 4, 240–246
Generic Instrument Description	A Shimadzu TOC-V Analyzer measures DOC by high temperature combustion method.

Dataset-specific Instrument Name	Shimadzu UV-1601
Generic Instrument Name	UV Spectrophotometer-Shimadzu
Dataset-specific Description	Porewater samples collected for: Total Dissolved Phosphorus and Ammonium Analytical Method: Spectrophotometry Instrument: Shimadzu UV-1601 Method Reference: Solorzano, L., and Sharp, J. H. 1980. Determination of total dissolved phosphorus and particulate phosphorus in natural waters. Limnol. Oceanogr. 25: 754-758. Solorzano, L. 1969. Determination of ammonia in natural waters by the phenolhypochlorite method. Limnol. Oceanogr. 14: 799-801
Generic Instrument Description	The Shimadzu UV Spectrophotometer is manufactured by Shimadzu Scientific Instruments (ssi.shimadzu.com). Shimadzu manufacturers several models of spectrophotometer; refer to dataset for make/model information.

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Deployments

ESAS_Fall_2011

Website	https://www.bco-dmo.org/deployment/641549
Platform	shoreside East Siberian Arctic Shelf
Start Date	2011-09-01
End Date	2011-10-31
Description	Siberia Cruise Porewater Samples Collected Sept-Oct, 2011

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Project Information

Collaborative Research: Degrading offshore permafrost as a source of methane on the East Siberian Arctic Shelf (East Siberian Arctic Shelf)

Website: http://www.joyeresearchgroup.uga.edu/research/climate-change/arctic-ecosystems/degrading-offshore-permafrost-source-methane

Coverage: East Siberian Arctic Shelf

From the NSF Award ABSTRACT
The Arctic region contains a huge amount of organic carbon, referred to as the Arctic Carbon Hyper Pool, within the Arctic Ocean sedimentary basin. This area has the highest documented rates of coastal sedimentation with annual accumulation rates of about 10 million metric tons organic C per year, which approximately equals the amount of sediment accumulated over the entire pelagic zone of the World Ocean. Due to the specific features of sedimentation and lithogenesis in this area, much of this organic carbon survives decomposition, and is buried within seabed sediments. These sediments are frozen annually or seasonally, representing a substantial reservoir of potentially labile organic carbon. Global warming in the arctic region is predicted to be substantial, and possibly rapid, in next few decades. Upon the melting of permafrost, old stored carbon will be reintroduced into the modern carbon biogeochemical cycle, possibly acting as a strong source of methane to the overlying water and potentially the atmosphere. Additionally, extremely large amounts of more ancient (Pleistocene) methane are trapped as gas hydrates within and beneath the permafrost. This research aims to elucidate the present and future methane flux potential of sediments and permafrost in regions of the East Siberian Arctic Shelf. As a result of global warming, seafloor permafrost along the East Siberian Arctic Shelf may experience a pronounced change in thermal regime. Increased temperature may affect permafrost in several ways, ultimately leading to its degradation and enhanced CH4 release. An international, interdisciplinary research team will determine the distribution and stability of permafrost on the East Siberian Arctic Shelf and evaluate this area as a methane source to the arctic region. Cores from eleven locations will be obtained using dry drilling techniques. Rates of biological methane production and consumption (oxidation) will be quantified in permafrost and sediments at in situ and elevated temperatures. Natural abundance stable carbon and hydrogen isotope measurements will be used to quantify the age and source of methane collected from different sites and depths. These data will be used as input to numerical models, which will be developed to describe the thermodynamic and biogeochemical aspects of permafrost methane dynamics. Using field data and modeling, the current and future potential release of methane from offshore permafrost will be determined and a methane budget for the East Siberian Arctic Shelf will be constructed.

BOOKS/ONE TIME PROCEEDING
Joye, S.B., V.A. Samarkin, N. Shakova, I.
Semiletov, and M.W. Bowles. "Methane dynamics along the East Siberian
Arctic Shelf: sources, sinks, and
fluxes to the atmosphere", 09/01/2011-08/31/2012, "*Gordon Research Conference on Polar
Marine Science*", 2011, "2011 GRC-PMC Ventura California".

Finke, N., S. Baer, and S.B. Joye. "Methane production in marine sea ice in
the Chukchi Sea, Barrow, Alaska", 09/01/2011-08/31/2012, "*Meeting Abstracts*", 2012, "NASA AbSciCon, Atlanta GA April".

Samarkin, V.A., I. Semelitov, N. Finke, N.
Shakhova, and S. B. Joye. "Methane stable isotope signatures in
waters and sediments of the Laptev Sea
Shelf", 09/01/2011-08/31/2012, "*Fall AGU meeting 2012*", 2012, "AGU Meeting Abstracts".

Project Summary

Collaborative Research: Degrading offshore permafrost as a current and potential source of atmospheric methane on the East Siberian Arctic Shelf

Intellectual Merit: The Arctic region contains a huge amount of organic carbon, referred to commonly as the “Arctic Carbon Hyper Pool”, within the Arctic Ocean sedimentary basin. The Russian Arctic shelf acts as an estuary of the Great Siberian Rivers. This area has the highest documented rates of coastal sedimentation with annual accumulation rates of about 10×106 t Corg yr-1, which approximately equals the amount of sediment accumulated over the entire pelagic zone of the World Ocean. Due to the specific features of sedimentation and lithogenesis in this area, much of this organic carbon survives decomposition, and is buried within seabed sediments. Some of these sediments are seasonally or annually frozen (“offshore” permafrost), representing a substantial reservoir of old but potentially labile organic carbon. Global warming in the Arctic region is predicted to be substantial, and possibly rapid, in the next few decades. Upon permafrost melting, the old carbon stored therein will be reintroduced into the modern carbon biogeochemical cycle, possibly acting as a strong source of methane to the overlying water and potentially the atmosphere. Additionally, extremely large amounts of more ancient (Pleistocene) methane are trapped as gas hydrates within and beneath the permafrost. **T**he proposed work aims to elucidate the present and future methane flux potential of sediments and permafrost in regions of the East Siberian Arctic Shelf. As a result of global warming, seafloor permafrost along the East Siberian Arctic Shelf may experience a pronounced change in thermal regime. Increased temperature may affect permafrost in several ways, ultimately leading

to its degradation and enhanced CH4 release. This international, interdisciplinary research team will determine the distribution and stability of permafrost on the East Siberian Arctic Shelf and evaluate this area as a methane source to the Arctic region. Cores from eleven locations will be obtained using dry drilling techniques. Rates of biological methane production and consumption (oxidation) will be quantified in permafrost and sediments at *in situ* and elevated temperatures.

Natural abundance carbon (13C and 14C) and hydrogen isotope measurements will be used to quantify the age and source of methane collected from different sites and depths. These data will be used as input to numerical models, which will be developed to describe the thermodynamic and biogeochemical aspects of permafrost methane dynamics. Using field data and modeling, the current and future potential release of methane from offshore permafrost will be determined and a methane budget for the East Siberian Arctic Shelf will be constructed.

Broader impacts: The proposed work will address a key aspect of the “International Polar Year” request for proposals by advancing the understanding of the coupled physical-geological-biological-chemical system of the Arctic Ocean and providing a predictive model of how the system will respond to environmental change. This work will elucidate the impact of global warming on methane dynamics in the Arctic; in particular, the current and potential capacity of sediments and permafrost to act as a methane source to the overlying water column and atmosphere will be quantified. The scientific team includes PIs with experience working in the Arctic (Semiletov, Shakova, Samarkin) as well as PIs new to this area (Joye, Meile). International collaborators (Grigoriev, Rekant, Kholodov) complete the research team by providing extensive expertise in geology and permafrost drilling in the Arctic. Besides supplying crucial data on CH4 fluxes to global change scientists, this proposal will promote training by supporting students at various levels and by reaching the public and interested scientists through a dedicated website. The project will contribute to the active outreach activities coordinated through the multi-agency Northern Eurasia Earth Science Partnership Initiative (NEESPI). This proposal will also contribute to the collaboration between two major Arctic nations, the United States and Russian Federation. All data generated during this project will be submitted to the BCO-DMO database.

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Funding

Funding Source	Award
NSF Division of Polar Programs (NSF PLR)	PLR-0908788

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