Spring 2011 - Master Data Sheet

Website: https://www.bco-dmo.org/dataset/644247
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
Joye, Samantha B.	University of Georgia (UGA)	Lead Principal Investigator, Contact
Meile, Christof	University of Georgia (UGA)	Co-Principal Investigator
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Dataset Description

Spring 2011 Sediment/Permafrost Master Data Sheet

Methods & Sampling

Spring 2011 Sediment/Permafrost Master Data Sheet

Collection Type: Gravity core; Drill core
Sampling Area: East Siberian Arctic Shelf
A negative depth value represents an overlying water sample
Rates were measured at stations 13 and 23 only.
Rates were quantified according to Orcutt et al. 2005 & Joye et al. 2010 in triplicate sub-samples plus killed controls
Geochemistry data was obtained according to Joye et al. 2011
MOG=methanogenesis
AOM=anaerobic oxidation of methane
CH4: methane
CO2: carbon dioxide

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 "0908788_Joye_Spring-2011_ Summary.xlsx", Sheet: "Sediment Master" contributed by Samantha Joye
- Parameter names edited to conform to BCO-DMO naming convention found at Choosing Parameter Name
- Lat and Lon converted to decimal degrees
- "nd" (no data) inserted into blank cells
- blank rows removed
- Spaces removed from Station, Collection Type and Date values to enable levelizing of data
- "B.D.L." converted to "BDL" (periods removed) to avoid potential data errors downstream
- "N.D." converted to "nd" (periods removed) to avoid potential data errors downstream and for consistency with "nd" (see above)

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Data Files

File	
Spring2011_Sed_Master.csv	(Comma Separated Values (.csv), 1.68 KB) MD5:ecbce63905006754afa703171e1517a6
Primary data file for dataset ID 644247	

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Parameters

Parameter	Description	Units
Station	Station	text
Collection_Type	Collection Type	text
Date	Date	text
Latitude	Station latitude (South is negative)	decimal degrees
Longitude	Station longitude (West is negative)	decimal degrees
Depth_Range	Depth Range	meters
Mid_point_Depth	Mid point Depth; A negative depth value represents an overlying water sample	meters
Joye_Lab_Sample_ID	Joye Lab Sample ID	dimensionless
CH4	CH4: methane	uM
DIC	DIC	mM
Porosity	Porosity	percentage
AOM_Rate	AOM Rate (AOM=anaerobic oxidation of methane)	pmol/cc/day
AOM_Turnover	AOM Turnover (AOM=anaerobic oxidation of methane)	percentage
C14_aceate_MOG_Rate	14C-aceate-MOG Rate (MOG=methanogenesis)	pmol/cc/day
H14CO3_MOG_turnover	H14CO3-MOG turnover (MOG=methanogenesis)	percentage

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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	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. (http://www.whoi.edu/instruments/viewInstrument.do?id=1079).

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Deployments

ESAS_Spring_2011

Website	https://www.bco-dmo.org/deployment/641548
Platform	shoreside East Siberian Arctic Shelf
Start Date	2011-04-01
End Date	2011-05-31
Description	Spring 2011 Sediment/Permafrost Collection Type: Gravity core; Drill core Sampling Area: East Siberian Arctic Shelf

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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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