

2012 Arctic Sediment/Permafrost Master

Website: <https://www.bco-dmo.org/dataset/644325>

Version: 20 April 2016

Version Date: 2016-04-20

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
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Table of Contents

- [Dataset Description](#)
 - [Methods & Sampling](#)
 - [Data Processing Description](#)
- [Data Files](#)
- [Parameters](#)
- [Instruments](#)
- [Deployments](#)
- [Project Information](#)
- [Funding](#)

Dataset Description

2012 Arctic Sediment/Permafrost Master

Methods & Sampling

2012 Arctic Sediment/Permafrost Master

Collection Type: Drill core

Samples were collected according to Joye et al. 2011

Gas samples were run on a flame ionizing detector and/or IRMS

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 2012_Sed_Summary.xlsx", Sheet: "Sed 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
- Station, Collection Type and Date values inserted
- "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)

[[table of contents](#) | [back to top](#)]

Data Files

File
Spring2012_Sed_Master.csv (Comma Separated Values (.csv), 2.93 KB) MD5:aac9ac82e70168aab638afb296f4e279
Primary data file for dataset ID 644325

[[table of contents](#) | [back to top](#)]

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
core	Core (Comment: Andy Montgomery: This column header was translated from Russian so I'm not entirely sure what it refers to. However my best guess is that it refers to drilling site so the adjacent lat/longs are based on that.)	dimensionless
drill_depth	Drill depth	meters
density	density	g/cc sediment
porosity	porosity	percentage
CH4_ppm	CH4 (ppm)	ppm
CH4_uM	CH4 (uM)	uM
CO2	CO2	uM
O2	O2	uM
N2	N2	uM
H2	H2	ppm
ethylene	ethylene	ppm
ethane	ethane	ppm
propylene	propylene	ppm
propane	propane	ppm
tray	tray (Comment: Andy Montgomery: This column header was translated from Russian so I'm not entirely sure what it refers to.)	dimensionless
bottle_no_a	Bottle # a (Comment: Andy Montgomery: This column header was translated from Russian so I'm not entirely sure what it refers to.) Note: "a" and "b" added to make parameters unique	dimensionless
bottle_no_b	Bottle # b (Comment: Andy Montgomery: This column header was translated from Russian so I'm not entirely sure what it refers to.) Note: "a" and "b" added to make parameters unique	dimensionless

[[table of contents](#) | [back to top](#)]

Instruments

Dataset-specific Instrument Name	Drill Core
Generic Instrument Name	Drill Core
Dataset-specific Description	Collection Type: 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	Flame Ionizing Detector
Generic Instrument Name	Flame Ionization Detector
Dataset-specific Description	Gas samples were run on a flame ionizing detector and/or IRMS
Generic Instrument Description	A flame ionization detector (FID) is a scientific instrument that measures the concentration of organic species in a gas stream. It is frequently used as a detector in gas chromatography. Standalone FIDs can also be used in applications such as landfill gas monitoring, fugitive emissions monitoring and internal combustion engine emissions measurement in stationary or portable instruments.

Dataset-specific Instrument Name	IRMS
Generic Instrument Name	Isotope-ratio Mass Spectrometer
Dataset-specific Description	Gas samples were run on a flame ionizing detector and/or IRMS
Generic Instrument Description	The Isotope-ratio Mass Spectrometer is a particular type of mass spectrometer used to measure the relative abundance of isotopes in a given sample (e.g. VG Prism II Isotope Ratio Mass-Spectrometer).

[[table of contents](#) | [back to top](#)]

Deployments

ESAS_Spring_2012

Website	https://www.bco-dmo.org/deployment/641552
Platform	shoreside East Siberian Arctic Shelf
Start Date	2012-03-01
End Date	2012-04-30
Description	2012 Arctic Sediment/Permafrost Collection Type: Drill core

[[table of contents](#) | [back to top](#)]

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. Semiletov, 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 10×10^6 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. The 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, Shakhova, 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.

[[table of contents](#) | [back to top](#)]

Funding

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

[[table of contents](#) | [back to top](#)]