

Spring 2012 - Turnover Rates

Website: <https://www.bco-dmo.org/dataset/644414>

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 |
| Samarkin, Vladimir | University of Georgia (UGA) | Co-Principal Investigator |
| Gegg, Stephen R. | Woods Hole Oceanographic Institution (WHOI BCO-DMO) | BCO-DMO Data Manager |

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Dataset Description

Spring 2012 - Turnover Rates

Methods & Sampling

2012 Arctic Sediment/Permafrost Turnover Rates

Collection Type: Gravity core; Drill core

Negative depth values represent overlying water samples

Rates were measured at stations 13 and 23 only.

Rate samples were measured according to Orcutt et al. 2005

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 Rates" 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

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Data Files

| File |
|--|
| Spring2012_Sed_Rates.csv (Comma Separated Values (.csv), 993 bytes) MD5:6645b19eab12887046dd162bb2e93177 |
| Primary data file for dataset ID 644414 |

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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 |
| 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 |
| AOM_Turnover | AOM Turnover (AOM=anaerobic oxidation of methane) | percentage |
| Fourteen_CH3COO_MOG_Turnover | 14-CH3COO- MOG Turnover (MOG=methanogenesis) | percentage |
| H14_CO3_MOG_Turnover | H14-CO3-MOG Turnover (MOG=methanogenesis) | percentage |

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Instruments

| | |
|---|--|
| Dataset-specific Instrument Name | Drill Core |
| Generic Instrument Name | Drill Core |
| Dataset-specific Description | Collection Type: Gravity core; 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 |
| Dataset-specific Description | Collection Type: Gravity core; Drill core |
| 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.who.edu/instruments/viewInstrument.do?id=1079). |

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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 |

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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.joyerresearchgroup.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, 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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