Radium in natural waters of Alaska

Website: https://www.bco-dmo.org/dataset/642378
Version:
Version Date: 2017-06-12

Project
» EAGER: Subterranean Ground Water Discharge (SGD) in the Arctic as a Source of Atmospheric Methane? A Proof of Concept Study (Groundwater Discharge Methane)

Contributors	Affiliation	Role
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Dataset Description

Ra-224, Ra-223, Th-228, and Ra-228 activity in ground, lake, river, and coastal ocean water of Alaska

Methods & Sampling

Sampling and Analytical Methodology:
Discrete seawater, groundwater, lake, and river water samples were collected from Kasitsna Bay and Toolik Lake in August 2011 and July 2012 and the Beaufort Sea August 2012. Groundwater samples were collected in all locations from freshly dug pits or temporary PVC well points of variable depth depending on the depth of the water table. All water samples were collected by submersible pump. Sample water was passed through a plastic column containing manganese dioxide impregnated acrylic fiber at a rate of <2 L/min for collection of Ra isotopes (Moore 2008). Samples were shipped to the University of California Santa Cruz for Analysis on a Radium Delayed Coincidence Counter (RaDeCC) for measurement of Ra-223 and Ra-224 activities within less than 5 days (Moore and Arnold 1996). The fibers were analyzed on the RadeCC again 3-5 weeks after collection to correct for Th-228 supported Ra-224, and one year after collection for Ra-228 (Moore 2008; Young et al. 2008). Standards were run on a monthly basis as part of the quality control for maintenance of the instrument and analytical errors calculated using established methods and were less than 10% (Garcia-Solsona et al. 2008).

Parameter names, definitions and units:
Latitude and longitude are in decimal degrees. Site refers to whether samples were collected on the Pacific Coast (Kastisna), Arctic Coast (Barrow), or tundra lake (Toolik). Activity of Ra-224, Ra-223, Th-228, and Ra-228 are in disintegrations per minute per 100L of water (dpm/100L).

Data Processing Description

Data Processing:
Data were converted from decays per minute measured by the RaDeCC to dpm/100L of water by standard calculation methods (Moore and Arnold 1996, Moore 2008).

BCO-DMO Processing Notes
- Generated from original file "AK Radium Data.xlsx" contributed by Alanna Lecher
- Parameter names edited to conform to BCO-DMO naming convention found at Choosing Parameter Name
- Longitude values converted to negative for West Longitude
- "nd" (no data) inserted into blank cells
- "#N/A" replaced with "nd" (no data)
- Date reformatted to YYYYMMDD
- Data version 12 Jun 2017 is an update of data version 14 Apr 2016. Bad lat 59..44807 changed to 59.44807.

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Data Files

File
Radium.csv (Comma Separated Values (.csv), 23.76 KB) MD5:d3de7f2765d20c9ae5758592aebbd70d Primary data file for dataset ID 642378

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Related Publications

Garcia-Solsona, E., Garcia-Orellana, J., Masqué, P., & Dulaiova, H. (2008). Uncertainties associated with 223Ra and 224Ra measurements in water via a Delayed Coincidence Counter (RaDeCC). Marine Chemistry, 109(3-4), 198–219. doi:10.1016/j.marchem.2007.11.006
Methods

Moore, W. S. (2008). Fifteen years experience in measuring 224Ra and 223Ra by delayed-coincidence counting. Marine Chemistry, 109(3-4), 188–197. doi:10.1016/j.marchem.2007.06.015
Methods

Moore, W. S., & Arnold, R. (1996). Measurement of 223Ra and224Ra in coastal waters using a delayed coincidence counter. Journal of Geophysical Research: Oceans, 101(C1), 1321–1329. doi:10.1029/95jc03139 https://doi.org/10.1029/95JC03139
Methods

Young, M. B., Gonneea, M. E., Fong, D. A., Moore, W. S., Herrera-Silveira, J., & Paytan, A. (2008). Characterizing sources of groundwater to a tropical coastal lagoon in a karstic area using radium isotopes and water chemistry. Marine Chemistry, 109(3-4), 377–394. doi:10.1016/j.marchem.2007.07.010
Methods

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Parameters

Parameter	Description	Units
Date	Sampling Date	YYYYMMDD
Site	Sampling Site (Site refers to whether samples were collected on the Pacific Coast (Kastisna); Arctic Coast (Barrow); or tundra lake (Toolik)	text
Sample_Type	Sample Type	text
Latitude	Latitude (South is negative)	decimal degrees
Longitude	Longitude (West is negative)	decimal degrees
Depth_Below_Surface	Depth_Below_Surface	meters
Salinity	Salinity	ppt
Temp	Temperature	Degs Celcius
Radium_224	Activity of Radium-224 in disintegrations per minute per 100L of water	dpm/100L
Radium_223	Activity of Radium-223 in disintegrations per minute per 100L of water	dpm/100L
Th_228	Activity of Th-228 in disintegrations per minute per 100L of water	dpm/100L
Ra_228	Activity of Ra-228 in disintegrations per minute per 100L of water	dpm/100L

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Instruments

Dataset-specific Instrument Name	Submersible Pump
Generic Instrument Name	Pump
Dataset-specific Description	Discrete seawater, groundwater, lake, and river water samples were collected from Kasitsna Bay and Toolik Lake in August 2011 and July 2012 and the Beaufort Sea August 2012. Groundwater samples were collected in all locations from freshly dug pits or temporary PVC well points of variable depth depending on the depth of the water table. All water samples were collected by submersible pump. Sample water was passed through a plastic column containing manganese dioxide impregnated acrylic fiber at a rate of
Generic Instrument Description	A pump is a device that moves fluids (liquids or gases), or sometimes slurries, by mechanical action. Pumps can be classified into three major groups according to the method they use to move the fluid: direct lift, displacement, and gravity pumps

Dataset-specific Instrument Name	Radium Delayed Coincidence Counter (RaDeCC)
Generic Instrument Name	Radium Delayed Coincidence Counter
Dataset-specific Description	Discrete seawater, groundwater, lake, and river water samples were collected from Kasitsna Bay and Toolik Lake in August 2011 and July 2012 and the Beaufort Sea August 2012. Groundwater samples were collected in all locations from freshly dug pits or temporary PVC well points of variable depth depending on the depth of the water table. All water samples were collected by submersible pump. Sample water was passed through a plastic column containing manganese dioxide impregnated acrylic fiber at a rate of
Generic Instrument Description	The RaDeCC is an alpha scintillation counter that distinguishes decay events of short-lived radium daughter products based on their contrasting half-lives. This system was pioneered by Giffin et al. (1963) and adapted for radium measurements by Moore and Arnold (1996). References: Giffin, C., A. Kaufman, W.S. Broecker (1963). Delayed coincidence counter for the assay of actinon and thoron. J. Geophys. Res., 68, pp. 1749-1757. Moore, W.S., R. Arnold (1996). Measurement of 223Ra and 224Ra in coastal waters using a delayed coincidence counter. J. Geophys. Res., 101 (1996), pp. 1321-1329. Charette, Matthew A.; Dulaiova, Henrieta; Gonneea, Meagan E.; Henderson, Paul B.; Moore, Willard S.; Scholten, Jan C.; Pham, M. K. (2012). GEOTRACES radium isotopes interlaboratory comparison experiment. Limnology and Oceanography - Methods, vol 10, pg 451.

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Deployments

ALASKA_Paytan_Radium_2011-2012

Website	https://www.bco-dmo.org/deployment/642091
Platform	shoreside ALASKA_Paytan
Start Date	2011-08-16
End Date	2012-08-05
Description	Discrete seawater, groundwater, lake, and river water samples were collected from Kasitsna Bay and Toolik Lake in August 2011 and July 2012 and the Beaufort Sea August 2012.

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Project Information

EAGER: Subterranean Ground Water Discharge (SGD) in the Arctic as a Source of Atmospheric Methane? A Proof of Concept Study (Groundwater Discharge Methane)

Coverage: Alaskan Pacific and Arctic Coastline, and Toolik Lake on the North Slope of Alaska

Extracted from the NSF award abstract:
The major objective of this proof of concept study is to evaluate the contribution of Subterranean Groundwater Discharge (SGD) in the Arctic to the global methane budget. Methane is a potent greenhouse gas and large natural reservoirs exist in Arctic soils and permafrost. The working hypothesis is that methane released from thawing permafrost in the Arctic is transported via groundwater flow (above and below the permafrost layer) and enters the atmosphere via coastal waters and lakes. This source of methane may be realized as an

important source of natural methane to the atmosphere and may provide a positive feedback to global warming.

The objectives of the study are:

1) To estimate the magnitude of subterranean groundwater discharge and associated methane flux into lakes and coastal waters in Alaska at three representative sites.

2) To evaluate methane evasion rates from the water column to the atmosphere.

3) To determine if the contribution of methane input from subterranean groundwater discharge to the global methane budget is significant, and if so

4) To use the preliminary data to design a more through research plan that will enable precise estimates of fluxes and provide a basis for global extrapolation of results such that the contribution of this source to current and future climate changes and the global methane budget will be possible.

The project will support a graduate student full time for two years. Undergraduate students in the ACCESS program and the California Alliance for Minority Participation in Science, Engineering and Mathematics program at UCSC will also participate in the proposed work. The PIs will work with COSEE Alaska to ntegrate this work in their outreach and education activities including teacher workshops, symposia, and work with local communities in Alaska.

PUBLICATIONS PRODUCED AS A RESULT OF THIS RESEARCH
Note: *When clicking on a Digital Object Identifier (DOI) number, you will be taken to an external site maintained by the publisher. Some full text articles may not yet be available without a charge during the embargo (administrative interval).*

Some links on this page may take you to non-federal websites. Their policies may differ from this site.

Ms. Alanna Lecher , Dr. Natasha Dimova , Ms. Katy Sparrow , Dr. Fenix Garcia-Tigreros , Mr. Joseph Murray , Dr. Slawek Tulaczyk , Dr. John Kessler. "Groundwater Discharge a Conduit for Methane Emissions in the Arctic," *Nature Geoscience*, 2015.

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Funding

Funding Source	Award
NSF Division of Polar Programs (NSF PLR)	PLR-1114485

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