Dissolved thorium-230 and thorium-232 from R/V Pelican cruise PE17-24 in the deep Northern Gulf of Mexico during June 2017

Website: https://www.bco-dmo.org/dataset/819622
Data Type: Cruise Results
Version: 1
Version Date: 2020-07-31

Project
» Collaborative Research: U.S. GEOTRACES Pacific Meridional Transect: Thorium-232, Thorium-230 and Protactinium-231 as tracers of trace element supply and removal (PMT Thorium Isotopes)

Contributors	Affiliation	Role
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Abstract
Dissolved thorium-230 and thorium-232 from the deep Northern Gulf of Mexico collected on R/V Pelican cruise PE17-24 during June 2017.

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Coverage

Spatial Extent: **N**:26.53 **E**:-90.824 **S**:26.526 **W**:-90.826
Temporal Extent: 2017-06-25

Dataset Description

Dissolved thorium-230 and thorium-232 from the deep Northern Gulf of Mexico collected on R/V Pelican cruise PE17-24 during June 2017.

Note: These data were collected through auxiliary activities in coordination with the GEOTRACES PMT project funded by NSF OCE-1737023.

Methods & Sampling

Sampling occurred according the GEOTRACES cookbook recommendations for radionuclides (https://www.geotraces.org/methods-cookbook/). Water was filtered from standard Niskin bottles through a 0.45 micron Acropak capsule filter and teflon line tygon tubing. Water was acidified to 0.024 M HCl using optima acid once the samples were returned to the lab about 2-3 days after collection. Water samples were left to sit acidified for at least 3 months prior to analysis to avoid adsorption loss.

Analysis of the thorium isotopes was by isotope dilution inductively-coupled plasma mass spectrometry as

described by Hayes et al. (2017). Briefly, thorium-229 was added to acidified 4-liter water samples and allowed to equilibrate overnight. About 10 mg of Fe from an iron chloride solution was added and pH was raised with optima ammonium hydroxide to 8-9 and iron (oxy)hydroxide precipitate was allowed to settle for 2 days. Overlaying seawater was decanted and the iron precipitate was isolated using a series of centrifugation steps. The precipitate was digested with HNO3, HF and H2O2, then thorium was purified using anion exchange resin AG1-X8. Final solutions were dried down and taken up in 2% HNO3 for analysis on ICP-MS.

Data Processing Description

Data processing: Thorium-230 and thorium-232 concentrations were determined using measured 232/229 and 230/229 ratios and a gravimetrically-calibrated Th-229 spike. Corrections for mass bias and tail-corrections were estimated using U-238/235 and U-234/235 ratios, respectively, using a uranium standard CRM-112a.

Quality flags: Data were flagged using the SeaDataNet quality flag scheme. For more information on SeaDataNet flags, see: https://www.geotraces.org/geotraces-quality-flag-policy/ and https://www.seadatanet.org/Standards/Data-Quality-Control

SeaDataNet quality flag definitions:
0 = No quality control;
1 = Good value;
2 = Probably good value;
3 = Probably bad value;
4 = Bad value;
5 = Changed value;
6 = Value below detection;
7 = Value in excess;
8 = Interpolated value;
9 = Missing value;
A = Value phenomenon uncertain.

BCO-DMO Processing:
- modified parameter names;
- added ISO8601 date/time fields;
- rounded Th_230_D_CONC_BOTTLE columns.

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Data Files

File
Thorium_PE17-24.csv (Comma Separated Values (.csv), 1.86 KB) MD5:3507c829402a3a93acaf9f7ca06b76f9
Primary data file for dataset ID 819622

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Related Publications

Hayes, C. T., Rosen, J., McGee, D., & Boyle, E. A. (2017). Thorium distributions in high- and low-dust regions and the significance for iron supply. Global Biogeochemical Cycles. doi:10.1002/2016gb005511 https://doi.org/10.1002/2016GB005511
Methods

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Parameters

Parameter	Description	Units
Station_ID	Station identifier	unitless
Start_Date_UTC	Start date; format: DD/MM/YYYY	unitless
Start_Time_UTC	Start time (UTC); format: hh:mm	unitless
Start_ISO_DateTime_UTC	Start date and time (UTC) formatted to ISO8601 standard: YYYY-MM-DDThh:mmZ	unitless
End_Date_UTC	End date; format: DD/MM/YYYY	unitless
End_Time_UTC	End time (UTC); format: hh:mm	unitless
End_ISO_DateTime_UTC	End date and time (UTC) formatted to ISO8601 standard: YYYY-MM-DDThh:mmZ	unitless
Start_Latitude	Start latitude	decimal degrees North
Start_Longitude	Start longitude	decimal degrees East
End_Latitude	End latitude	decimal degrees North
End_Longitude	End longitude	decimal degrees East
Event_ID	Event identifer	unitless
Sample_ID	Sample identifier	unitless
Sample_Depth	Sample depth	meters (m)
Th_230_D_CONC_BOTTLE_xdopme	Concentration (or activity) of dissolved 230Th	microBecquerels per kilogram (uBq/kg)
SD1_Th_230_D_CONC_BOTTLE_xdopme	One standard deviation of Th_230_D_CONC_BOTTLE_xdopme	microBecquerels per kilogram (uBq/kg)
Flag_Th_230_D_CONC_BOTTLE_xdopme	Quality flag for Th_230_D_CONC_BOTTLE_xdopme	unitless

Th_232_D_CONC_BOTTLE_bf1qqr	Concentration (or activity) of dissolved 232Th	picomoles per kilogram (pmol/kg)
SD1_Th_232_D_CONC_BOTTLE_bf1qqr	One standard deviation of Th_232_D_CONC_BOTTLE_bf1qqr	picomoles per kilogram (pmol/kg)
Flag_Th_232_D_CONC_BOTTLE_bf1qqr	Quality flag for Th_232_D_CONC_BOTTLE_bf1qqr	unitless

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Instruments

Dataset-specific Instrument Name	Inductively-coupled plasma mass spectrometry
Generic Instrument Name	Inductively Coupled Plasma Mass Spectrometer
Generic Instrument Description	An ICP Mass Spec is an instrument that passes nebulized samples into an inductively-coupled gas plasma (8-10000 K) where they are atomized and ionized. Ions of specific mass-to-charge ratios are quantified in a quadrupole mass spectrometer.

Dataset-specific Instrument Name	Niskin bottles
Generic Instrument Name	Niskin bottle
Generic Instrument Description	A Niskin bottle (a next generation water sampler based on the Nansen bottle) is a cylindrical, non-metallic water collection device with stoppers at both ends. The bottles can be attached individually on a hydrowire or deployed in 12, 24, or 36 bottle Rosette systems mounted on a frame and combined with a CTD. Niskin bottles are used to collect discrete water samples for a range of measurements including pigments, nutrients, plankton, etc.

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Deployments

PE17-24

Website	https://www.bco-dmo.org/deployment/782553
Platform	R/V Pelican
Start Date	2017-06-23
End Date	2017-06-26
Description	Additional information is available from the Rolling Deck to Repository (R2R): https://www.rvdata.us/search/cruise/PE17-24 Cruise DOI: 10.7284/907751

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Project Information

Collaborative Research: U.S. GEOTRACES Pacific Meridional Transect: Thorium-232, Thorium-230 and Protactinium-231 as tracers of trace element supply and removal (PMT Thorium Isotopes)

NSF Award Abstract:
The goal of the international GEOTRACES program is to understand the distributions of trace chemical elements and their isotopes in the oceans. Many trace elements are essential for life and their extremely low concentrations in seawater are thought to limit biological productivity (fertility) throughout much of the ocean. This limitation, in turn, partially constrains the level of fisheries that can be supported by marine ecosystems as well as the ocean's capacity to absorb carbon dioxide from the atmosphere. Whereas the importance of these trace-element micronutrients is well established, many basic features of their ocean distribution remain unknown. Measurements of other elements and isotopes can be used to understand the processes that influence the distributions of the micronutrient elements. Two naturally-occurring radioactive isotopes that are particularly important in this regard are thorium-230 and protactinium-231, which have been designated as key parameters to be measured as part of GEOTRACES. This project will focus on the measurement of these two isotopes in order to provide critical information about the processes that supply iron to the Pacific Ocean, as well as the rates of those processes. The project will support an early career investigator, a postdoctoral researcher, and students at the undergraduate and graduate levels.

Samples of seawater and of suspended particulate material will be collected along a north-south transect between Alaska and Tahiti to examine the processes that supply and remove trace elements. These samples will be analyzed for naturally-occurring radionuclides thorium-232, thorium-230 and protactinium-231. Aerosol samples and sediments collected along the transect will be analyzed as well. In collaboration with other investigators involved in the expedition, this project will:

1) Interpret the distributions of thorium-232 and thorium-230 to quantify the supply of iron and other trace elements delivered by dust as well as the trace elements supplied by chemical reactions in volcanic sediments along the Alaskan margin,
2) Determine the sinking flux of major particulate phases and of particulate trace elements throughout the water column to quantify their rate of removal from the ocean, and
3) Compare the rate of trace element removal among contrasting environmental regimes to be encountered along the Alaska to Tahiti transect to identify the key physical, chemical and biological factors, such as dust supply and biological productivity, that regulate the rate of trace element removal from the ocean.

Note: Additional datasets from cruises PE17-24 and PS1718 were collected as complementary activities to this project and were supported by NSF award OCE-1737023.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1737023

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