

Dissolved thorium-230 and thorium-232 from R/V Point Sur cruise PS1718 at the site of the former Deepwater Horizon in April 2017

Website: <https://www.bco-dmo.org/dataset/819674>

Data Type: Cruise Results

Version: 1

Version Date: 2020-07-28

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 R/V Point Sur cruise PS1718 at the site of the former Deepwater Horizon in April 2017.

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Coverage

Spatial Extent: N:28.732 E:-88.329 S:28.723 W:-88.451

Temporal Extent: 2017-04-01

Dataset Description

Dissolved thorium-230 and thorium-232 from the site of the former Deepwater Horizon on R/V Point Sur cruise PS1718 in April 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.

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Data Files

| File |
|--|
| Thorium_PS1718.csv (Comma Separated Values (.csv), 1.71 KB) MD5:2fe725cd1daf6d85259ae1e1f0c59c94 |
| Primary data file for dataset ID 819674 |

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Parameters

| Parameter | Description | Units |
|----------------|------------------------------|----------|
| Station_ID | Station identifier | unitless |
| Start_Date_UTC | Start date; format: MM-DD-YY | 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: MM-DD-YY | 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 identifier | unitless |
| Sample_ID | Sample identifier | unitless |
| Sample_Depth | Sample depth | meters (m) |
| Th_230_D_CONC_BOTTLE_ebau1z | Concentration (or activity) of dissolved 230Th | microBecquerels per kilogram (uBq/kg) |
| SD1_Th_230_D_CONC_BOTTLE_ebau1z | One standard deviation of Th_230_D_CONC_BOTTLE_ebau1z | microBecquerels per kilogram (uBq/kg) |
| Flag_Th_230_D_CONC_BOTTLE_ebau1z | Quality flag for Th_230_D_CONC_BOTTLE_ebau1z | unitless |
| Th_232_D_CONC_BOTTLE_vioy5b | Concentration (or activity) of dissolved 232Th | picomoles per kilogram (pmol/kg) |
| SD1_Th_232_D_CONC_BOTTLE_vioy5b | One standard deviation of Th_232_D_CONC_BOTTLE_vioy5b | picomoles per kilogram (pmol/kg) |
| | | |

| | | |
|----------------------------------|---|----------|
| Flag_Th_232_D_CONC_BOTTLE_vioy5b | Quality flag for Th_232_D_CONC_BOTTLE_vioy5b | 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

PS1718

| | |
|-------------------|---|
| Website | https://www.bco-dmo.org/deployment/819663 |
| Platform | R/V Point Sur |
| Start Date | 2017-04-01 |
| End Date | 2017-04-02 |

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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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