Dissolved Pb concentration data from the US GEOTRACES Arctic Expedition (GN01, HLY1502) from August to October 2015

Website: https://www.bco-dmo.org/dataset/762056

Data Type: Cruise Results

Version: 1

Version Date: 2019-03-12

Project

» U.S. Arctic GEOTRACES Study (U.S. GEOTRACES Arctic)

» Collaborative Research: GEOTRACES Arctic section: Spatial variability of lead concentrations and isotopic compositions in the western Arctic basins (GEOTRACES Arctic Pb)

Program

» U.S. GEOTRACES (U.S. GEOTRACES)

Contributors	Affiliation	Role
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Abstract

Dissolved Pb concentration data from the US GEOTRACES Arctic Expedition (GN01, HLY1502).

Table of Contents

Coverage

Spatial Extent: **N**:89.995 **E**:179.5926 **S**:60.165 **W**:-179.8082

Temporal Extent: 2015-08-12 - 2015-10-08

Dataset Description

Dissolved Pb concentration data from the US GEOTRACES Arctic Expedition (GN01, HLY1502).

Acquisition Description

Samples were collected according to Cutter and Bruland 2012, utilizing a trace metal clean rosette (GT-C rosette). Samples above 20 m were pumped from a hole drilled in the ice far away from the ship or from a small boat, using clean sampling techniques. Dissolved Pb analyses were performed using techniques described in Lagerstrom et al. (2013). Samples were acidified to pH 1.8 and left for 2 months prior to analysis. Intercalibration results were submitted to and approved by the GEOTRACES S & I committee (see Supplmental Documents).

Processing Description

WOCE Quality Flags:
2 – Ok,
3 – Questionable,
4 – Bad Analysis,
5 – Sample lost,
6 – Mean of replicates,
9 – Sample was not collected for Pb analysis.

[table of contents | back to top]

Related Publications

Cutter, G. A., & Bruland, K. W. (2012). Rapid and noncontaminating sampling system for trace elements in global ocean surveys. Limnology and Oceanography: Methods, 10(6), 425–436. doi:10.4319/lom.2012.10.425

Lagerström, M. E., Field, M. P., Séguret, M., Fischer, L., Hann, S., & Sherrell, R. M. (2013). Automated on-line flow-injection ICP-MS determination of trace metals (Mn, Fe, Co, Ni, Cu and Zn) in open ocean seawater: Application to the GEOTRACES program. Marine Chemistry, 155, 71–80. doi:10.1016/j.marchem.2013.06.001

[table of contents | back to top]

Parameters

Parameter	Description	Units
EXPOCODE	Cruise EXPO code	unitless
SECT_ID	Section ID	unitless
STNNBR	Station number	unitless
CASTNO	Cast number	unitless
DATE	Date (UTC); format: yyyymmdd	unitless
TIME	Time (UTC); format: HHMM	unitless
LATITUDE	Latitude; positive values = North	decimal degrees
LONGITUDE	Longitude; positive values = East	decimal degrees
CTDPRS	CTD Pressure	decibars
CTDDEPTH	CTD Depth	meters (m)
GEOTRC_SAMPNO	GEOTRACES sample number	unitless
GEOTRC_EVENTNO	Event number	unitless
SAMPNO	Sequential sample number within the cast (usually corresponds to bottle number).	unitless
BTLNBR	Bottle number; typically 1-24.	unitless
PB_D_CONC_BOTTLE	Dissolved lead (Pb) concentration	picomoles per kilogram (pMol/kg)
PB_CONC_FLAG	WOCE Quality Flag for PB_D_CONC_BOTTLE	unitless

[table of contents | back to top]

Instruments

Dataset-specific Instrument Name	ThermoFinnigan Element 2 Inductively Coupled Plasma Mass Spectrometer coupled (ICP-MS)
Generic Instrument Name	Inductively Coupled Plasma Mass Spectrometer
Dataset-specific Description	Dissolved Pb was measured at the University of Alaska, Fairbanks using an ThermoFinnigan Element 2 Inductively Coupled Plasma Mass Spectrometer coupled (ICP-MS) to an Elemental Scientific SeaFAST S2 (syringe based system).
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	trace metal clean rosette (GT-C rosette)
Generic Instrument Name	GO-FLO Teflon Trace Metal Bottle
Generic Instrument Description	GO-FLO Teflon-lined Trace Metal free sampling bottles are used for collecting water samples for trace metal, nutrient and pigment analysis. The GO-FLO sampling bottle is designed specifically to avoid sample contamination at the surface, internal spring contamination, loss of sample on deck (internal seals), and exchange of water from different depths.

[table of contents | back to top]

Deployments

HLY1502

Website	https://www.bco-dmo.org/deployment/638807
Platform	USCGC Healy
Report	http://dmoserv3.whoi.edu/data_docs/GEOTRACES/Arctic/ARC01-report.pdf
Start Date	2015-08-09
End Date	2015-10-12
Description	US GEOTRACES Arctic cruise: The cruise began in Dutch Harbor, Alaska on 08 October 2015. After a station in the Bering Sea, Healy cruised to the North Pole on a westerly track before returning to the Canadian margin on an easterly track, returning to Dutch Harbor on 10 October 2015.

[table of contents | back to top]

Project Information

U.S. Arctic GEOTRACES Study (U.S. GEOTRACES Arctic)

Coverage: Arctic Ocean; Sailing from Dutch Harbor to Dutch Harbor

Description from NSF award abstract: In pursuit of its goal "to identify processes and quantify fluxes that control the distributions of key trace elements and isotopes in the ocean, and to establish the sensitivity of these distributions to changing environmental conditions", in 2015 the International GEOTRACES Program will embark on several years of research in the Arctic Ocean. In a region where climate warming and general environmental change are occurring at amazing speed, research such as this is important for understanding the current state of Arctic Ocean geochemistry and for developing predictive capability as the regional ecosystem continues to warm and influence global oceanic and climatic conditions. The three investigators funded on this award, will manage a large team of U.S.scientists who will

compete through the regular NSF proposal process to contribute their own unique expertise in marine trace metal, isotopic, and carbon cycle geochemistry to the U.S. effort. The three managers will be responsible for arranging and overseeing at-sea technical services such as hydrographic measurements, nutrient analyses, and around-the-clock management of on-deck sampling activites upon which all participants depend, and for organizing all pre- and post-cruise technical support and scientific meetings. The management team will also lead educational outreach activities for the general public in Nome and Barrow, Alaska, to explain the significance of the study to these communities and to learn from residents' insights on observed changes in the marine system. The project itself will provide for the support and training of a number of pre-doctoral students and post-doctoral researchers. Inasmuch as the Arctic Ocean is an epicenter of global climate change, findings of this study are expected to advance present capability to forecast changes in regional and globlal ecosystem and climate system functioning. As the United States' contribution to the International GEOTRACES Arctic Ocean initiative, this project will be part of an ongoing multi-national effort to further scientific knowledge about trace elements and isotopes in the world ocean. This U.S. expedition will focus on the western Arctic Ocean in the boreal summer of 2015. The scientific team will consist of the management team funded through this award plus a team of scientists from U.S. academic institutions who will have successfully competed for and received NSF funds for specific science projects in time to participate in the final stages of cruise planning. The cruise track segments will include the Bering Strait, Chukchi shelf, and the deep Canada Basin. Several stations will be designated as so-called super stations for intense study of atmospheric aerosols, sea ice, and sediment chemistry as well as water-column processes. In total, the set of coordinated international expeditions will involve the deployment of ice-capable research ships from 6 nations (US, Canada, Germany, Sweden, UK, and Russia) across different parts of the Arctic Ocean, and application of state-of-the-art methods to unravel the complex dynamics of trace metals and isotopes that are important as oceanographic and biogeochemical tracers in the sea.

Collaborative Research: GEOTRACES Arctic section: Spatial variability of lead concentrations and isotopic compositions in the western Arctic basins (GEOTRACES Arctic Pb)

Coverage: Arctic

NSF Award Abstract: In this project, investigators participating in the 2015 U.S. GEOTRACES Arctic expedition will measure lead concentrations and isotopic compositions in seawater, snow, and aerosol samples collected in the western Arctic Ocean. In common with other national initiatives in the International GEOTRACES Program, the goals of the U.S. Arctic expedition are to identify processes and quantify fluxes that control the distributions of key

trace elements and isotopes in the ocean, and to establish the sensitivity of these distributions to changing environmental conditions. Some trace elements are essential to life, others are known biological toxins, and still others are important because they can be used as tracers of a variety of physical, chemical, and biological processes in the sea. Lead is an important substance to measure because it is a toxic trace element, ranked 2nd in the US Agency for Toxic Substances Disease Registry, and can be utilized as a tracer of ocean processes. The study will provide for the training and support of graduate and postdoctoral researchers. Lead (Pb) is emitted into the atmosphere by high temperature industrial activities and leaded gasoline consumption and is globally dispersed by the atmosphere. High concentrations of Pb have been observed in Arctic ice cores and aerosols, and there are significant concerns about Pb, mercury, and other toxic trace elements in Arctic ecosystems. However, there remain significant questions about how these toxic trace elements and their isotopes currently exist in the Arctic, as well as how they will change in the future Arctic as a result of retreating summer sea ice and extensive drilling, mining, and industrialization. This proposal is aimed at remedying this deficiency in scientific knowledge by measuring Pb and Pb isotopes from seawater profiles, sea ice/seawater interface, snow and aerosols that will be collected during the U.S. GEOTRACES western Arctic transect. Specifically, researchers will gain knowledge on 1) the penetration of anthropogenic lead into the Arctic Ocean, 2) the primary sources of lead to surface waters, 3) the distributions of lead and their relation to scavenging processes and rates, 4) how the exchange with sinking particles contributes to lead?s distribution, and 5) ocean circulation in the Arctic using lead as a tracer. Results from the study will have important implications for human health by increasing understanding of the distribution and abundance of a toxic trace element.

[table of contents | back to top]

Program Information

U.S. GEOTRACES (U.S. GEOTRACES)

Website: http://www.geotraces.org/

Coverage: Global

GEOTRACES is a SCOR sponsored program; and funding for program infrastructure development is provided by the U.S. National Science Foundation. GEOTRACES gained momentum following a special symposium, S02: Biogeochemical cycling of trace elements and isotopes in the ocean and applications to constrain contemporary marine processes (GEOSECS II), at a 2003 Goldschmidt meeting convened in Japan. The GEOSECS II acronym referred to the Geochemical Ocean Section Studies To determine full water column distributions of selected trace elements and isotopes, including their concentration, chemical speciation, and physical form, along a sufficient number of sections in each ocean basin to establish the principal relationships between these distributions and with more traditional hydrographic parameters; * To evaluate the sources, sinks, and internal cycling of these species and thereby characterize more completely the physical, chemical and biological processes regulating their distributions, and the sensitivity of these processes to global change; and * To understand the processes that control the concentrations of geochemical species used for proxies of the past environment, both in the water column and in the substrates that reflect the water column. GEOTRACES will be global in scope, consisting of ocean sections complemented by regional process studies. Sections and process studies will combine fieldwork, laboratory experiments and modelling. Beyond realizing the scientific objectives identified above, a natural outcome of this work will be to build a community of marine scientists who understand the processes regulating trace element cycles sufficiently well to exploit this knowledge reliably in future interdisciplinary studies. Expand "Projects" below for information about and data resulting from individual US GEOTRACES research projects.

[table of contents | back to top]

Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1459270

[table of contents | back to top]