CTD profiles from the ODF rosette on the US GEOTRACES Pacific Meridional Transect (PMT) cruise (GP15) from September to November 2018

Website: https://www.bco-dmo.org/dataset/778168
Data Type: Cruise Results
Version: 2
Version Date: 2020-07-22

Project
» US GEOTRACES Pacific Meridional Transect (GP15) (U.S. GEOTRACES PMT)

Program
» U.S. GEOTRACES (U.S. GEOTRACES)

Contributors	Affiliation	Role
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Abstract
CTD profiles from the ODF rosette on the US GEOTRACES Pacific Meridional Transect (PMT) cruise (GP15) from September to November 2018.

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Coverage

Spatial Extent: **N**:56.0585 **E**:-151.9879 **S**:-20 **W**:-156.9627
Temporal Extent: 2018-09-24 - 2018-11-23

Methods & Sampling

The description below is excerpted from the GP15 Cruise Report (PDF). Refer to cruise report for more information, including the complete problem report and CTD processing details.

The 36-place Scripps Ocean Data Facility (ODF) rosette was used to sample water for less contamination-prone elements. Casciotti (Stanford, co-cruise leader), along with Marty Fleisher (LDEO) and Colette Kelly (Stanford) were responsible for managing the water budget and overall sampling of the ODF rosette. The ODF group was responsible for maintenance and calibration of the rosette bottles and instrumentation.

Cast types included 'Demi' station casts to 1000 m, shallow casts to 400-1000m, intermediate casts from 400-2000 m, and deep casts to within 40 m of the bottom. At each full and super station, an additional cast of the ODF rosette was conducted to sample large volumes for pigments, Radium, and Thorium isotopes (PigRaTh). On the PigRaTh casts, eight depths were selected to match the shallowest eight pump depths. Another four depths were chosen for resolution of Th-234, and a surface bottle was tripped for a 13th sample depth. The surface bottle was used primarily

to sample dissolved gases at the sea surface, rather than drawing from the towfish or the ship's underway system. Surface bottle sampling also occurred at demi stations (13 depths sampled instead of 12).

CTDO/rosette casts were performed with a package consisting of a 36 bottle rosette frame, a 36-place carousel and 36 Bullister style Niskin bottles with an absolute volume of 10.6L. Underwater electronic components primarily consisted of a SeaBird Electronics housing unit with Paroscientific pressure sensor with dual plumbed lines where each line has a pump, temperature sensor, conductivity sensor, and exhaust line. A SeaBird Electronics membrane oxygen sensor was mounted on the "primary" line. A reference thermometer, transmissometer, chlorophyll-a fluorometer and backscatter meter, oxygen optode, altimeter and for some casts, a monocore were also mounted on the rosette.

Data Processing Description

The description below is excerpted from the GP15 Cruise Report (PDF). Refer to cruise report for more information, including the complete problem report and CTD processing details.

Shipboard CTD data processing was performed after deployment using SIO/ODF python CTD processing software v. 0.3. CTD acquisition data were copied onto a OS X system, and then processed. CTD data at bottle trips were extracted, and a 2-decibar down-cast pressure series created. A number of issues were encountered during GP15 ODF that directly impacted CTD analysis. Issues that directly impacted bottle closures, such as slipping guide rings, were detailed in the Underwater Sampling Package section of the ODF report.

_FLAG_W columns follow the WOCE Hydrographic Program (WHP) quality flag definitions.

The WHP quality codes for the water bottle itself are:
1 = Bottle information unavailable.
2 = No problems noted.
3 = Leaking.
4 = Did not trip correctly.
5 = Not reported.
6 = Significant discrepancy in measured values between Gerard and Niskin bottles.
7 = Unknown problem.
8 = Pair did not trip correctly. Note that the Niskin bottle can trip at an unplanned depth while the Gerard trips correctly and vice versa.
9 = Samples not drawn from this bottle.
(Flags 6, 7, and 8 apply primarily to large volume samplers.)

The WHP bottle parameter data quality codes are:
1 = Sample for this measurement was drawn from water bottle but analysis not received. Note that if water is drawn for any measurement from a water bottle, the quality flag for that parameter must be set equal to 1 initially to ensure that all water samples are accounted for.
2 = Acceptable measurement.
3 = Questionable measurement.
4 = Bad measurement.
5 = Not reported.
6 = Mean of replicate measurements (Number of replicates should be specified).
7 = Manual chromatographic peak measurement.
8 = Irregular digital chromatographic peak integration.
9 = Sample not drawn for this measurement from this bottle.

The WHP CTD data quality codes are:
1 = Not calibrated.
2 = Acceptable measurement.
3 = Questionable measurement.
4 = Bad measurement.
5 = Not reported.
6 = Interpolated over >2 dbar interval.
7 = Despiked.
8 = Not assigned for CTD data.
9 = Not sampled.

BCO-DMO Processing:
- parsed file headers to obtain STNNBR, CASTNO, DATE, TIME, LATITUDE, LONGITUDE, and DEPTH;
- concatenated data files for separate casts into one dataset;
- 2020-07-22: joined to GP15 event log to obtain EVENTNO (matching values on STNNBR + CASTNO); added ISO8601 date/time format.

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Data Files

File
GP15_CTD_ODF.csv (Comma Separated Values (.csv), 14.43 MB) MD5:83ac06d61e3b97159994a58dd436be67 Primary data file for dataset ID 778168

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Supplemental Files

File
Rinko III Calibration Sheet filename: ARO-CAV0296_170410.pdf (Portable Document Format (.pdf), 843.57 KB) MD5:da29b7ebfd29c76299d1deccf151db23 Calibration sheet for the RINKO III deployed on the GEOTRACES PMT cruise.
Rinko III Manual filename: RinkoIII_Manual.pdf (Portable Document Format (.pdf), 5.03 MB) MD5:fa44761dbe044f0f8994902bafda7cdd Rinko III Manual for instrument deployed on GEOTRACES PMT cruise

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Parameters

Parameter	Description	Units
EXPOCODE	Expedition code	unitless
SECT_ID	Section ID	unitless
INSTRUMENT_ID	Instrument ID number from CTD file header	unitless
EVENTNO	Event number; obtained from the cruise event log	unitless
STNNBR	Station number; from CTD file header	unitless
CASTNO	Cast Identifier; from CTD file header	unitless
DATE	Date from CTD file header; format: yyyymmdd	unitless
TIME	Time from CTD file header; format: HHMM	unitless
LATITUDE	Latitude from CTD file header; positive values = North	decimal degrees
LONGITUDE	Longitude from CTD file header; positive values = East	decimal degrees

DEPTH	Bottom depth; from CTD file header	meters (m)
Event_Descrip	Event description; obtained from the cruise event log	unitless
CTDPRS	Sample/sensor pressure	decibars
CTDPRS_FLAG_W	WHP quality flag for CTDPRS	unitless
CTDTMP	Temperature from CTD sensor in the ITS-90 convention	degrees Celsius
CTDTMP_FLAG_W	WHP quality flag for CTDTMP	unitless
CTDSAL	Practical salinity from CTD sensor on the PSS-1978 scale	psu
CTDSAL_FLAG_W	WHP quality flag for CTDSAL	unitless
CTDOXY	Concentration of dissolved oxygen from sensor on CTD	micromoles per kilogram (umol/kg)
CTDOXY_FLAG_W	WHP quality flag for CTDOXY	unitless
CTDRINKO	Voltage from RINKO dissolved oxygen sensor	volts
CTDRINKO_FLAG_W	WHP quality flag for CTDRINKO	unitless
CTDXMISS	Transmissometer	volts
CTDXMISS_FLAG_W	WHP quality flag for CTDXMISS	unitless
CTDFLUOR	Fluorescence from CTD sensor	volts
CTDFLUOR_FLAG_W	WHP quality flag for CTDFLUOR	unitless
ISO_DateTime_UTC	Date and time (UTC) formatted to ISO8601 standard: YYYY-MM-DDThh:mmZ	yyyy-MM-dd'T'HH:mm'Z'

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Instruments

Dataset-specific Instrument Name	
Generic Instrument Name	CTD Sea-Bird
Generic Instrument Description	A Conductivity, Temperature, Depth (CTD) sensor package from SeaBird Electronics. This instrument designation is used when specific make and model are not known or when a more specific term is not available in the BCO-DMO vocabulary. Refer to the dataset-specific metadata for more information about the specific CTD used. More information from: http://www.seabird.com/

Dataset-specific Instrument Name	
Generic Instrument Name	Niskin bottle
Dataset-specific Description	CTDO/rosette casts were performed with a package consisting of a 36 bottle rosette frame, a 36-place carousel and 36 Bullister style Niskin bottles with an absolute volume of 10.6L.
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.

Dataset-specific Instrument Name	
Generic Instrument Name	Rinko III ARO-CAV Oxygen Sensor
Dataset-specific Description	A RINKO III (ARO-CAV) optical dissolved oxygen sensor was deployed on this cruise. See the following documents for more information: ARO-CAV0296_170410.pdf (calibration certificate provided by ODF) RinkoIII_Manual.pdf (Rinko manual provided by ODF)
Generic Instrument Description	The RINKO III is a fast-response optical dissolved oxygen (DO) and temperature sensor. The DO sensor is coated with photostimulable phosphor (PSP) on the outside of the pressure-resistant acrylic optical window, measuring phosphorescence quenching phase shift. The excitation blue LED pulse generates a red phosphorescence pulse, which in turn has an inverse correlation with the oxygen partial pressure in the water. It is an analogue output version. It has a response time of less than 1 second in air, enabling dissolved oxygen measurements with continuous profiling at high speeds. The dissolved oxygen sensor has a non-linear accuracy of +/-2% of full scale (at 1atm, 25 deg C) and the temperature sensor +/-0.02 deg C. It has a pressure rating of 7000 m. This device is made by JFE Advantech Co. Ltd.

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Deployments

RR1815

Website	https://www.bco-dmo.org/deployment/776917
Platform	R/V Roger Revelle
Report	https://datadocs.bco-dmo.org/docs/geotraces/GEOTRACES_PMT/casciotti/data_docs/GP15_Cruise_Report_with_ODF_Report.pdf
Start Date	2018-10-24
End Date	2018-11-24
Description	Additional cruise information is available from the Rolling Deck to Repository (R2R): https://www.rvdata.us/search/cruise/RR1815

RR1814

Website	https://www.bco-dmo.org/deployment/776913
Platform	R/V Roger Revelle
Report	https://datadocs.bco-dmo.org/docs/geotraces/GEOTRACES_PMT/casciotti/data_docs/GP15_Cruise_Report_with_ODF_Report.pdf
Start Date	2018-09-18
End Date	2018-10-21
Description	Additional cruise information is available from the Rolling Deck to Repository (R2R): https://www.rvdata.us/search/cruise/RR1814

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Project Information

US GEOTRACES Pacific Meridional Transect (GP15) (U.S. GEOTRACES PMT)

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

Coverage: Pacific Meridional Transect along 152W (GP15)

A 60-day research cruise took place in 2018 along a transect form Alaska to Tahiti at 152° W. A description of the project titled "*Collaborative Research: Management and implementation of the US GEOTRACES Pacific Meridional Transect*", funded by NSF, is below. Further project information is available on the US GEOTRACES website and on the cruise blog. A detailed cruise report is also available as a PDF.

Description from NSF award abstract:
GEOTRACES is a global effort in the field of Chemical Oceanography in which the United States plays a major role. The goal of the GEOTRACES program is to understand the distributions of many elements and their isotopes in the ocean. Until quite recently, these elements could not be measured at a global scale. Understanding the distributions of these elements and isotopes will increase the understanding of processes that shape their distributions and also the processes that depend on these elements. For example, many "trace elements" (elements that are present in very low amounts) are also important for life, and their presence or absence can play a vital role in the population of marine ecosystems. This project will launch the next major U.S. GEOTRACES expedition in the Pacific Ocean between Alaska and Tahiti. The award made here would support all of the major infrastructure for this expedition, including the research vessel, the sampling equipment, and some of the core oceanographic measurements. This project will also support the personnel needed to lead the expedition and collect the samples.

This project would support the essential sampling operations and infrastructure for the U.S. GEOTRACES Pacific Meridional Transect along 152° W to support a large variety of individual science projects on trace element and isotope (TEI) biogeochemistry that will follow. Thus, the major objectives of this management proposal are: (1) plan and coordinate a 60 day research cruise in 2018; (2) obtain representative samples for a wide variety of TEIs using a conventional CTD/rosette, GEOTRACES Trace Element Sampling Systems, and in situ pumps; (3) acquire conventional CTD hydrographic data along with discrete samples for salinity, dissolved oxygen, algal pigments, and dissolved nutrients at micro- and nanomolar levels; (4) ensure that proper QA/QC protocols are followed and reported, as well as fulfilling all GEOTRACES intercalibration protocols; (5) prepare and deliver all hydrographic data to the GEOTRACES Data Assembly Centre (via the US BCO-DMO data center); and (6) coordinate all cruise communications between

investigators, including preparation of a hydrographic report/publication. This project would also provide baseline measurements of TEIs in the Clarion-Clipperton fracture zone (~7.5°N-17°N, ~155°W-115°W) where large-scale deep sea mining is planned. Environmental impact assessments are underway in partnership with the mining industry, but the effect of mining activities on TEIs in the water column is one that could be uniquely assessed by the GEOTRACES community. In support of efforts to communicate the science to a wide audience the investigators will recruit an early career freelance science journalist with interests in marine science and oceanography to participate on the cruise and do public outreach, photography and/or videography, and social media from the ship, as well as to submit articles about the research to national media. The project would also support several graduate students.

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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.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1657781
NSF Division of Ocean Sciences (NSF OCE)	OCE-1658318
NSF Division of Ocean Sciences (NSF OCE)	OCE-1657944

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