

Combined CTD profiles for two CTD sensor packages on R/V Knorr KN192-05 from November to December 2007

Website: <https://www.bco-dmo.org/dataset/773715>

Data Type: Cruise Results

Version: 0

Version Date: 2019-07-29

Project

» [Cobalt, Iron and Micro-organisms from the Upwelling zone to the Gyre \(GAc01\)](#) (CoFeMUG)

Programs

» [Ocean Carbon and Biogeochemistry](#) (OCB)

» [U.S. GEOTRACES](#) (U.S. GEOTRACES)

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Coverage

Spatial Extent: N:-11 E:14.5 S:-25 W:-30

Temporal Extent: 2007-11-18 - 2007-12-11

Dataset Description

Three transects were sampled using the Trace Metal Rosette (TMR) on the CoFeMUG cruise aboard R/V Knorr in 2007. This dataset contains the combined two CTD sensor packages deployed during the transect. Refer to Noble et al. (2012) for detailed information on acquisition and processing.

Related Publications:

Noble, A.E., C. H. Lamborg, D. C. Ohnemus, P. J. Lam, T. J. Goepfert, C. I. Measures, C. H. Frame, K. L. Casciotti, G. R. DiTullio, J. Jennings, M. A. Saito. 2012. Basin-scale inputs of cobalt, iron, and manganese from the Benguela-Angola front to the South Atlantic Ocean. *Limnology and Oceanography*, 57(4) 989-1010.
doi:[10.4319/l.2012.57.4.0989](https://doi.org/10.4319/l.2012.57.4.0989)

Sohm, J. A., J. A. Hilton, A. E. Noble, J. P. Zehr, M. A. Saito, and E. A. Webb. 2011. Nitrogen fixation in the South Atlantic Gyre and the Benguela Upwelling System. *Geophys. Res. Letters*. 38: L16608,
doi:[10.1029/2011GL048315](https://doi.org/10.1029/2011GL048315)

Methods & Sampling

CTD: Two CTD packages were employed on KN-192-5, the Knorr's Seabird 911+ CTD package and the science party's Seabird-19 sensor package. The Seabird-19 was deployed on the science party's trace metal rosette for the deep casts to ~5000m, while the ship's CTD was deployed to 800m for upper water casts. The two packages were needed due to wire time constraints, as there was insufficient time to send both rosettes deep at each station. Oxygen data for the two CTD were calibrated with shipboard winkler titrations as described in Noble et al. Limnol. Oceanogr. 2012. The Seabird-19 was calibrated in the factory immediately prior to the cruise.

Data Processing Description

BCO-DMO Processing Notes:

- Modified original parameter names to conform with BCO-DMO naming conventions;
- Missing values (blank) were replaced with 'nd' to indicate 'no data'.

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Parameters

Parameter	Description	Units
cruise_id	Ship's cruise designation	unitless
Station	Station number	unitless
Type	Type of cast	unitless
mon_day_yr	date; reported in GMT as MM-DD-YYYY	unitless
hh_mm	time of day; reported in GMT as hhmm	unitless
lon	longitude; East is positive; West is negative	decimal degrees
lat	latitude; North is positive; South is negative	decimal degrees
depth_w	water depth	meters (m)
depth	Sample depth	meters (m)
cond	conductivity	Seimens per meter (S/m)
Spar	Surficial Photosynthetically Available Radiation	microEinsteins/meter ² /second
Par	Photosynthetically Available Radiation	microEinsteins/meter ² /second

Cpar	Cosine Photosynthetically Available Radiation	microEinsteins/meter ² /second
fluor	FIECO-AFL fluorescence	milligrams per cubic meter (mg/m ³)
Xmiss	transmissivity	unknown
pot_dens	sigma-e00 sigma-theta potential density	kilograms per cubic meter (kg/m ³)
O2	dissolved oxygen concentration	micromole per kilogram (umol/kg)
Potemp090C	potential temperature	degrees C
Sal00	salinity	parts per thousand
ISO_DateTime	date and time in UTC of CTD cast in ISO-8601 format	yyyy-MM-dd'THH:mm:ss

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Instruments

Dataset-specific Instrument Name	Seabird 911+ CTD
Generic Instrument Name	CTD Sea-Bird SBE 911plus
Dataset-specific Description	the Knorr's Seabird 911+ CTD package was deployed to 800m for upper water casts
Generic Instrument Description	The Sea-Bird SBE 911 plus is a type of CTD instrument package for continuous measurement of conductivity, temperature and pressure. The SBE 911 plus includes the SBE 9plus Underwater Unit and the SBE 11plus Deck Unit (for real-time readout using conductive wire) for deployment from a vessel. The combination of the SBE 9 plus and SBE 11 plus is called a SBE 911 plus. The SBE 9 plus uses Sea-Bird's standard modular temperature and conductivity sensors (SBE 3 plus and SBE 4). The SBE 9 plus CTD can be configured with up to eight auxiliary sensors to measure other parameters including dissolved oxygen, pH, turbidity, fluorescence, light (PAR), light transmission, etc.). more information from Sea-Bird Electronics

Dataset-specific Instrument Name	Seabird-19
Generic Instrument Name	CTD Sea-Bird SEACAT 19
Dataset-specific Description	The Seabird-19 was deployed on the science party's trace metal rosette for the deep casts to ~5000m.
Generic Instrument Description	The Sea-Bird SBE 19 SEACAT Recorder measures conductivity, temperature, and pressure (depth). The SEACAT is self-powered and self-contained and can be deployed in profiling or moored mode. The SBE 19 SEACAT was replaced in 2001 by the 19plus. more information from Sea-Bird Electronics

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Deployments

KN192-05

Website	https://www.bco-dmo.org/deployment/57852
Platform	R/V Knorr
Report	http://bcodata.whoi.edu/CoFeMUG/CruiseReport_KN192-5.pdf
Start Date	2007-11-16
End Date	2007-12-13

Description	<p>The South Atlantic subtropical gyre and Benguela Upwelling region were sampled for chemistry and biological properties relating to the trace metal nutrition and phytoplankton diversity and productivity. Specifically cobalt and iron dissolved seawater concentrations will be measured and related to the abundance of cyanobacteria including nitrogen fixers and eukaryotic phytoplankton. The phytoplankton of the Benguela Upwelling region were also examined to determine if their growth was iron or cobalt limited. A total of 27 station locations were occupied in the study area to collect the water chemistry and biological samples for these analyses (see cruise track). Iron and cobalt analyses will be conducted using inductively coupled plasma mass spectrometry and cathodic stripping voltammetry electrochemical methods. The sample preparation and subsequent analyses are technically demanding, but data generated from the cruise samples are being contributed beginning in mid 2009. The CoFeMUG KN192-5 cruise was supported by NSF OCE award # 0452883 http://www.nsf.gov/awardsearch/showAward.do?AwardNumber=0452883 A station map showing the 27 sampling locations is available as a PDF file. Original cruise data are available from the NSF R2R data catalog CoFeMUG - South Atlantic 2007 Cruise Participant List 1. Mak Saito (Chief Scientist/WHOI) 2. Abigail Noble (Saito/WHOI) 3. Alysia Cox (Saito/WHOI) 4. Whitney Krey (Delong/Saito/MIT/WHOI) 5. Carl Lamborg (clamborg AT whoi.edu/WHOI) 6. Phoebe Lam (pjlam AT whoi.edu WHOI) 7. Chad Hammerschmidt (chammerschmidt AT whoi.edu, Wright State) 8. Caitlin Frame (cframe AT whoi.edu, WHOI/Casciotti Student) 9. Tyler Goepfert (tgoepfert AT whoi.edu Webb/Saito) 10. Jill Sohm (sohm AT usc.edu) 11. Maria Intermaggio 12. Jack DiTullio (leep AT cofc.edu U. Charleston) 13. Peter Lee (DiTullio U. Charleston) 14. Sarah Riseman (DiTullio U. Charleston) 15. Amanda McLennan (amanda.mclennan AT gmail.com, DiTullio U. Charleston) 16. Mike Seracki (Bigelow) 17. Nicole Poulton (Bigelow) 18. Juan Alba, juanalba AT usp.br (Bigelow) 19. Jane Heywood (Bigelow) 20. Gabrielle Roca (rocap AT whoi.edu, U. Washington) 21. Emily Nahas (enahas AT u.washington.edu) 22. Michele Wrable (mlw22 AT u.washington.edu) 23. Bob Morris (rmorris AT lifesci.ucsb.edu) 24. Christian Frazar (Chris, U. Washington, Morris lab) 25. Jason Hilton (Zehr, UCSC) 26. Reserved for Angolan Observers 27. Reserved for Angolan Observers Collecting GEOTRACES-compliant samples for: 1. Laura Robinson (Pa Th isotopes) 2. Bob Anderson (Pa Th isotopes - intercalibration) 3. Olivier Rouxel (Se and Fe isotopes) 4. Karen Casciotti (N isotopes) 5. Ben Reynolds (Si and Fe isotopes) 6. Chris Measures (Al) 7. Kristin Buck (FeL)</p>
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Project Information

Cobalt, Iron and Micro-organisms from the Upwelling zone to the Gyre (GAc01) (CoFeMUG)

Coverage: South Atlantic subtropical gyre and Benguela upwelling region

The geochemistries of dissolved cobalt (Co) and iron (Fe) in the oceanic water column share several characteristics such as extremely low concentrations, redox chemistry, low solubility, and utilization as micronutrients by marine microbes. Iron has been the subject of considerable research focus in recent years due to its role in limiting phytoplankton productivity in oceanic and coastal upwelling environments. Cobalt has been much less studied, but recent data show it may be important in influencing primary productivity or phytoplankton community composition in certain geographical areas.

The CoFeMUG project predated GEOTRACES, so while it is not formally recognized as a GEOTRACES section, it is considered a GEOTRACES-related project and the CoFeMUG data are GEOTRACES compliant.

State-of-the-art geochemical and molecular biological techniques were used to address biogeochemical questions in the South Atlantic, and focus especially on the two trace metals, cobalt and iron. The 27-day cruise in November and December 2007 to the South Atlantic was designed to study cobalt and iron biogeochemistry and focus on four major hypotheses.

- (1) Large fluxes of labile cobalt are associated with upwelling systems even in Aeolian dominated environments.
- (2) Cobalt and phosphate show correlations in (and only in) surface waters due to micronutrient utilization and

rapid remineralization. The slope of the correlation is dependent on the chemical speciation of cobalt.

(3) The absence of Trichodesmium populations in the subtropical and tropical South Atlantic is caused by iron limitation.

(4) Based on work from the California and Peru Upwelling regimes, primary productivity in the Benguela upwelling regime off of South West Africa may be iron limited or iron-cobalt colimited.

A combination of geochemical and biological/molecular analyses were made across an oligotrophic-upwelling transition to examine how changing metal regimes affect the physiology and growth of the important primary producers Trichodesmium and Synechococcus.

CoFeMUG project results are published in:

Noble, Abigail E., Carl H. Lamborg, Dan C. Ohnemus, Phoebe J. Lam, Tyler J. Goepfert, Chris I. Measures, Caitlin H. Frame, Karen L. Casciotti, Giacomo R. DiTullio, Joe Jennings, and Mak A. Saito (2012) Basin-scale inputs of cobalt, iron, and manganese from the Benguela-Angola front to the South Atlantic Ocean. *Limnology & Oceanography*. Vol. 57(4), July 2012. pgs 989-1010. doi:10.4319/lo.2012.57.4.0989

(www.aslo.org/lo/toc/vol_57/issue_4/0989.pdf)

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Program Information

Ocean Carbon and Biogeochemistry (OCB)

Website: <http://us-ocb.org/>

Coverage: Global

The Ocean Carbon and Biogeochemistry (OCB) program focuses on the ocean's role as a component of the global Earth system, bringing together research in geochemistry, ocean physics, and ecology that inform on and advance our understanding of ocean biogeochemistry. The overall program goals are to promote, plan, and coordinate collaborative, multidisciplinary research opportunities within the U.S. research community and with international partners. Important OCB-related activities currently include: the Ocean Carbon and Climate Change (OCCC) and the North American Carbon Program (NACP); U.S. contributions to IMBER, SOLAS, CARBOOCEAN; and numerous U.S. single-investigator and medium-size research projects funded by U.S. federal agencies including NASA, NOAA, and NSF.

The scientific mission of OCB is to study the evolving role of the ocean in the global carbon cycle, in the face of environmental variability and change through studies of marine biogeochemical cycles and associated ecosystems.

The overarching OCB science themes include improved understanding and prediction of: 1) oceanic uptake and release of atmospheric CO₂ and other greenhouse gases and 2) environmental sensitivities of biogeochemical cycles, marine ecosystems, and interactions between the two.

The OCB Research Priorities (updated January 2012) include: ocean acidification; terrestrial/coastal carbon fluxes and exchanges; climate sensitivities of and change in ecosystem structure and associated impacts on biogeochemical cycles; mesopelagic ecological and biogeochemical interactions; benthic-pelagic feedbacks on biogeochemical cycles; ocean carbon uptake and storage; and expanding low-oxygen conditions in the coastal and open oceans.

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-0452883

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